VOL. 6 NO. 21
November 15, 1981

Energy Research Abstracts

ABSTRACTS 31529-32802

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications which are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the energy data base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $4.00, foreign $5.00 per copy; annual cumulative index, domestic $6.00, foreign $7.50 per copy. The annual subscription price is $44.00 for domestic subscribers and $55.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. Indexes are cumulated semiannually and annually. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes will also be available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $45.00 for domestic subscribers and $90.00 for subscribers outside the North American Continent. A single issue is $6.00 (domestic) and $12.00 (outside the North American Continent).

Current Energy Patents (CEP)

A monthly publication providing abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. Available as PB81-902800.

Energy Conservation Update (ECU)

A monthly abstract journal devoted to current information on energy conservation in buildings, transportation and propulsion, and industry; waste processing plants and equipment; energy storage; energy conversion; advanced automotive systems; combustion systems; power cycles; synthetic fuels; and power transmission. Available as PB81-914800.

Energy and the Environment (EAE)

A monthly abstract journal devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment. Available as PB81-914900.

Fossil Energy Update (FEU)

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB81-914600.

Fusion Energy Update (CFU)

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB81-915300.

Geothermal Energy Update (GEU)

A monthly abstract journal devoted to information on the exploration and development of geothermal resources. Available as PB81-914700.

Solar Energy Update (SEU)

A monthly abstract journal devoted to information on the utilization of solar, tidal, and wind energy. Available as PB81-914500.

Synthetic Fuels Update (SFU)

A monthly abstract journal devoted to information on coal gasification; coal liquefaction; other coal processing; biomass conversion to fuel; shale oil and tar sand bitumen production; hydrogen fuels; other hydrocarbon fuels; alcohol fuels; and inorganic hydrogen compound fuels. Available as PB81-902700.

INTERNATIONAL ENERGY PUBLICATIONS

Atomindex (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $293.

Coal Abstracts (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides all non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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Editor's Note

Printed cumulative indexes will be prepared for *Energy Research Abstracts (ERA)*, Volume 6 for 1981. The Volume 7, 1982 subscription will provide the 24 semimonthly issues only. No printed cumulative indexes will be prepared for *ERA*, Volume 7, 1982. For those not making use of one or more of the on-line systems, TIC expects to make available a microfiche version of *ERA* annual indexes for Volume 7. Sources and prices for these microfiche will be announced at a later date.

With Volume 7, the coverage of *Energy Research Abstracts* will be broadened to announce all unclassified, publicly available reports processed by the Technical Information Center. This coverage increase will result in the inclusion of 10,000 additional abstracts. Discontinuance of the cumulative indexes will offset the cost of this additional coverage.

The total content of *ERA* is maintained on a continuing basis in the Energy Data Base (EDB). EDB is available for searching via the DOE/RECON on-line system and is also available commercially via Bibliographic Retrieval Service (BRS). Commercial availability via Dialog and Orbit will be added in the fall. This widespread availability of constantly cumulating indexes to *ERA* information decreases the usefulness of printed cumulative indexes to an impractical level.

The editorial staff believes its decision to rely on computerized systems for retrospective searching is both forward thinking and cost-effective. It is expected that any inconvenience to *ERA* users will be minimal.

Dave E. Bost

NOTICE

ENERGY RESEARCH ABSTRACTS, Volume 6
Semiannual Index, Jan.–June, 1981

Report Number Index

Please note the *Availability* column of the Report Number Index, wherein part of the usual Price Code citation for most of the reports available from NTIS is missing. Example: a citation that should appear as NTIS, PC A02/MF A01 is displayed only as 02/MF A01. Apparently, the excision occurred during the printing–photocomposition cycle. Availability information may be found also in the abstract citation for the referenced abstract number.

There will be no reprinting; therefore, it is suggested that users annotate their copies noting that NTIS, PC A should precede most of the NTIS availability cited. The information will appear correctly in the *ERA* Volume 6 Annual Cumulative Index.

energinfo ERA

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center, as the national information center for the Department of Energy, manages, publishes, and disseminates scientific, technical, and practical energy information acquired from worldwide sources. It builds and maintains energy information data bases used to prepare abstracting journals, bibliographies, and literature searches. The data bases are also searchable via the Department's on-line retrieval system, DOE/RECON. This information is provided to DOE program offices and contractors; scientists; engineers; educational, commercial, and industrial communities; and the general public. The Technical Information Center conducts an active announcement and marketing program. It establishes policy and administers control of an inventory and registry for DOE publications. The Center also develops and evaluates new and effective information systems and services as required by scientific and technical management within the Department of Energy.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, conservation, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Federal, state, and municipal agencies concerned with energy development, conservation, and usage may obtain *ERA* free of charge. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes are also available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

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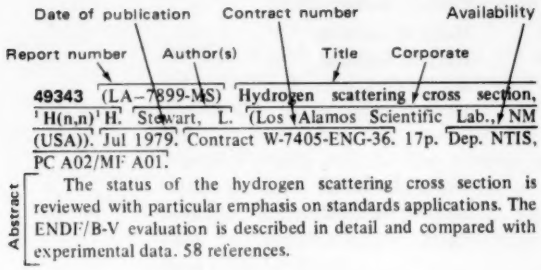
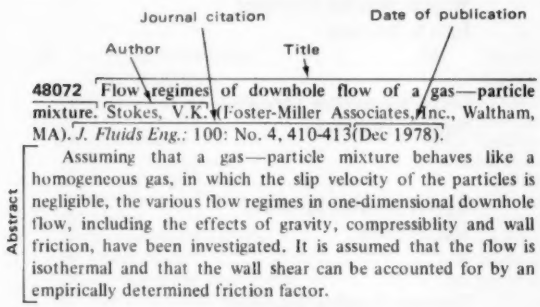
•ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Date of publication
Contract number
Availability
Report number
Author(s)
Title
Corporate
49343 (LA–7899-MS) Hydrogen scattering cross section, ¹H(n,n)¹H. Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.
Abstract
The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. 58 references.


Journal citation
Date of publication
Author
Title
48072 Flow regimes of downhole flow of a gas—particle mixture. Stokes, V.K. (Foster-Miller Associates, Inc., Waltham, MA). J. Fluids Eng.: 100: No. 4, 410-413 (Dec 1978).
Abstract
Assuming that a gas—particle mixture behaves like a homogeneous gas, in which the slip velocity of the particles is negligible, the various flow regimes in one-dimensional downhole flow, including the effects of gravity, compressiblity and wall friction, have been investigated. It is assumed that the flow is isothermal and that the wall shear can be accounted for by an empirically determined friction factor.

•INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. These indexes are cumulated semiannually and annually. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

•Corporate Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

49343 (LA–7899-MS) Hydrogen scattering cross section, ¹H(n,n)¹H. Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Advanced laser fusion target fabrication research and development proposal, 4:48249 (LA–7619-P)
Hydrogen scattering cross section, ¹H(n,n)¹H, 4:49343 (LA–7899-MS)

•Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Stewart, L., Hydrogen scattering cross section, ¹H(n,n)¹H, 4:49343 (LA–7899-MS)
Stewart, M.D., *See* McInroy, J.F., 4:49280
Stewart, W., *See* Dean, J.W., 4:48543
Stimson, J., Reproduction, growth, and survival of Enewetak corals, 4:49200 (NVO–0703-1, pp 56-59)

•Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles and informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

HYDROGEN I TARGET
Neutron Reactions
Hydrogen scattering cross section, ¹H(n,n)¹H (Above 100 keV, review), 4:49343 (LA–7899-MS)
HYDROGEN NITRATES
See NITRIC ACID
HYDROLOGY
Research Programs
Inventory of advanced energy technologies and energy conservation research and development: 1976-1978. Volume II. Prepared for the Committee on Science and Technology, U.S. House of Representatives, 96*th* Congress, 4:48749.

•Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos Scientific Lab., NM (USA)**	
	3:49698	LA-tr–78-45
	3:49857	LA–7224T
	3:49863	LA–7235-MS
W-7405-ENG-48	**California Univ., Livermore (USA). Lawrence Livermore Lab.**	
	3:49386	UCRL–52456
	3:49431	UCRL–52405

•Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience.

LA-		
7899-MS	4:49343	Dep. NTIS, PC A02/MF A01
LA-tr-		
78-69	4:48158	Dep. NTIS, PC A03/MF A01

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Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts*, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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ENERGY RESEARCH ABSTRACTS

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31529 (ORNL/TM—7908) Fossil-energy program. Progress report for June 1981. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 121p. NTIS, PC A06/MF A01. Order Number DE81028037.

This report - the eighty-third of series - is a compendium of monthly progress reports for the ORNL research and development programs that are in support of the increased utilization of coal and other fossil fuel alternatives as sources of clean energy. The projects reported this month include those for coal conversion development, chemical research and development, materials technology, component development and process evaluation, technical support to major liquefaction projects, process analysis and engineering evaluations, fossil energy environmental analysis, flue gas desulfurization, coal preparation waste utilization, atmospheric fluidized bed coal combustor for cogeneration, TVA FBC demonstration plant program technical support, PFBC systems analysis, fossil fuel applications assessments, performance assurance system support for fossil energy projects, international energy technology assessment, generalized equilibrium models for liquid and gaseous fuel supplies, analyses of coal production goals, and fossil energy information center.

0104 Processing

REFER ALSO TO CITATION(S) 31559, 31561, 31561, 31569, 31570, 31609, 31818, 31849, 32147, 32147

31530 Oil and gas from coal. Olliver, D. London, England; Financial Times Business Information Ltd. ([nd]). 4p.

This book includes seven chapters on the pioneering of oil from coal in Germany, in South African experience, Sasol reaches maturity in plants Two and Three, the prospect for indirect conversion, modern developments in direct conversion of coal, gasification of coal, and the outlook for oil and gas from coal. Information from the US/DOE is included as appendices. The book is intended for management people. (DLC)

31531 (CONF-810731—2) Metallurgical study of a failed heat exchanger in a h-coal pilot plant. Gray, R.J.; Keiser, J.R.; DeVan, J.H.; Searles, R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01. Order Number DE81027283.

From 14. annual technology meeting of international metallographic society; San Francisco, CA, USA (21 Jul 1981).

The H-Coal Pilot Plant at Catlettsburg, Kentucky, is designed to process 600 tons of coal per day and produce synthetic fuels. On September 20, 1980, operation of the pilot plant was interrupted when a heat exchanger (a reactor effluent vapor/steam thermo syphon reboiler) failed. Three alloy 800 (Fe-32Ni-21Cr) tubes in the bottom return section (cold end) of the heat exchanger blew out of the tubesheet. The system was shut down and a team of investigators began an intense study. After examination of the fractured tubes by optical and scanning electron microscopy, a conclusion was made that stress corrosion cracking originating at the exterior surface was the cause of the failure. Other tubes were found that were approaching a state of failure. 11 figures.

31532 (DOE/ET/10154—T11) Operation of the solvent-refined-coal pilot plant, Wilsonville, Alabama. Annual technical report, January-December 1980. Lewis, H.E. (Catalytic, Inc., Wilsonville, AL (USA)). Aug 1981. Contract AC01-76ET10154. 190p. (FE—2270-79). NTIS, PC A09/MF A01. Order Number DE81025515.

The plant was in operation for the equivalent of 247 days, an on-stream factor of 67.7%. Kentucky 9 coals from the Lafayette, Dotiki and Fies mines were processed. During 1980, the operating conditions and equipment were adjusted to evaluate potential process improvements. These experiments produced significant results in the following areas: Operating V103 High Pressure Separator in the hot mode; varying T102 Vacuum Column operating temperature; adding light SRC (LSRC), a product of the third stage of the Critical Solvent Deashing (CSD) unit, to the process solvent; investigating the effects of the chlorine content of the feed coal on corrosion in the process vessels; evaluating the effects of adding sodium carbonate on corrosion rates; operating under conditions of low severity; i.e., low reactor temperature and long residence time; and testing an alternate CSD deashing solvent. A series of simulation runs investigating the design operating conditions for a planned 6000 ton per day SRC-I demonstation plant were also completed. Numerous improvements were made in the CSD processing area, and the components for a hydrotreating unit were installed.

31533 (DOE/ET/10296—T2) Molten-Salt Coal-Gasification Process Development Unit, Phase 2. Quarterly technical progress report No. 3, January-March 1981. Slater, M.H. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 20 Apr 1981. Contract AC21-77ET10296. 57p. (ESG-DOE—13363). NTIS, PC A04/MF A01. Order Number DE81023585.

This represents the third quarterly progress report on Phase 2 of the Molten Salt Coal Gasification Process Development Unit Program. Phase 1 of this program started in March 1976 and included the design, construction, and initial operation of the PDU. On June 25, 1980, Phase 2 of the program was initiated. It covers a 1-year operations program utilizing the existing PDU and is planned to include a series of runs, each additional run progressively utilizing more plant hardware and subsystems and operating under increasingly severe conditions. Run 7, the second run of the Phase 2 program, was completed. The gasification system was operated for a total of 169 h at pressures up to 90 psig. Average product gas HHV values of 81 Btu/scf were recorded during 90-psig operation, while gasifying coal at a rate of 735 lb/h. The run was terminated, as planned, after 7 full days of operation. Prior to Run 7, an 80% cobalt-20% chromium alloy metal melt withdrawal orifice was installed as a replacement for a high-purity alumina orifice which had cracked during Run 6; and thus, it is suspected, contributed to the overflow system plug which prematurely terminated the test. The new metal orifice survived the entire Run 7 campaign virtually intact. Minor diagnostic instrumentation additions are being incorporated into the product gas and quench tank green liquor systems. During Run 7, several short-lived system pressure excursions were experienced. Since the existing instrumentation is predominantly operations oriented, detailed evaluation of anomalous behavior is difficult.

31534 (DOE/ET/13060—T9) Pipeline-gas Demonstration Plant: Phase I. Quarterly technical process report, 1 January 1981 - 31 March 1981. DiFulgentiz, R.A. (comp. and ed.). (Conoco, Inc., Stamford, CT (USA)). 1981. Contract AC01-77ET13060. 34p. (FE—2542-36). NTIS, PC A03/MF A01. Order Number DE81027894.

Contract No EF-77-C-01-2542 between Conoco Inc. and the U.S. Department of Energy provides for the design, construction, and operation of a demonstration plant capable of processing bituminous caking coal into clean pipeline quality gas. During the reporting period of January 1, 1981, through March 31, 1981, the major work effort of the project was focused on Task VI, Demonstration Plant Engineering and Design, and on Task VII, Construction Planning. Work continued on plans for obtaining coal, catalysts, chemicals, and flux, and on plans for sale of the products and by-products. Work on Task VIII, Economic Reassessment, was started during the reporting period. The design phase of the pro-

ject, Phase I, is scheduled for completion on June 30, 1981. Conoco Inc. expects to meet all major milestone dates and complete Phase I on schedule.

31535 **(DOE/ET/13108—T15) Site qualification studies of the UCG/SDB site, North Knobs, Wyoming.** Davis, B.E.; Krajewski, S.A.; Ahner, P.F.; Avasthi, J.M.; Dolde, M.E.; Greenman, C.A.; Miranda, J.E. (Gulf Science and Technology Co., Pittsburgh, PA (USA). Chemical and Minerals Div.). 23 May 1979. Contract AC03-77ET13108. 388p. NTIS, PC A17/MF A01. Order Number DE81026084.

The site qualification program for the North Knobs UCG site near Rawlins, Wyoming has been completed. This site will be the location for the field tests of Underground Coal Gasification of Steeply Dipping Beds undertaken by Gulf Research and Development Company for DOE in a cost shared contract. Site characterization included a comprehensive geotechnical analysis along with vegetation, historical, and archeological studies. The G coal seam chosen for these tests is a subbituminous B coal with a true seam thickness of 22 feet and has thin coal benches above and below the main seam. The water table is at 90 feet below the surface. Hydrologic studies have defined the seam as an aquiclude (non-aquifer). The site is deemed restorable to regulatory requirements. Evaluation of this site indicates total acceptability for the three-test program planned by GR and DC.

31536 **(DOE/ET/14879—T6) Desulfurization with transition metal catalysts.** Eisch, J.J. (State Univ. of New York, Binghamton (USA). Dept. of Chemistry). 31 Jul 1981. Contract AC22-79ET14879. 4p. NTIS, PC A02/MF A01. Order Number DE81028935.

During the seventh quarter of this two-year contract the following aspects of desulfurization were pursued: (1) study of the reactivity and the intermediates in the desulfurization of 2-methyldibenzothiophene and certain model sulfides and sulfones; (b) examination of the ratio of bis-1.5-cyclooctadiene-nickel; (c) exploration of the desulfurizing activity of soluble organocobalt complexes; (d) evaluation of the activity of aluminum hydride combinations with nickel(II), cobalt(II) and molybdenum(0) or molybdenum(IV) salts; and (e) planning experimental procedures for applying these techniques to coal-derived liquids. The following results have been obtained: (1) the desulfurization of 2-methyldibenzothiophene has been shown to be much slower than that of dibenzothiophene, and the product has been identified as 3-methylbiphenyl exclusively; as to sulfones, some interesting desulfurization routes have been revealed; (b) a 1:1 ratio of bis-1,5-cyclooctadiene-nickel(0) and α,α'-dipyridyl exhibits an optimal desulfurization action; ratios of 1:2 or 2:1 are decidedly less effective; (c) the preparation os the complex, 1,5-cyclooctadiene(3-cyclooctenyl)cobalt has been completed and this complex, combined with α,α'-bipyridyl in tetrahydrofuran solution at 65 to 70°C, proved to be an effective desulfurizing agent toward dibenzothiophene; (d) the generation of low-valent metal desulfurizing agents in situ, namely by the treatment of metal salts with $LiAlH_4$ or R_2AlCl, shows considerable promise with nickel(II) and cobalt(II) salts, but not much for molybdenum carbonyls or molybdenum(IV) salts; and (e) a literature search is underway to identify suitable manipulative and analytical techniques for attempted desulfurizations of SRC=II coal liquids.

31537 **(DOE/ET/14928—1) Experimental evaluation of the steady-state and dynamic performance characteristics of the interactive units of a coal-gasification process. Quarterly report, 28 December 1980-29 March 1981.** Corman, J.C. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Apr 1981. Contract AC01-80ET14928. 75p. NTIS, PC A04/MF A01. Order Number DE81028995.

Coal gasification/gas cleanup fuel plants for synthetic fuel applications must be developed within the constraints imposed by dynamic load response to variations in end-use demand and compliance with environmental regulations. The overall objective of the program is to develop the technology base required to premit coal conversion systems to operate within the constraints imposed by end-use applications. The fuel plant performance will be characterized in both steady state and dynamic operations; component interactions and end-use interactions will also be characterized. The information required to establish system control logic will be developed. The combined experimental/analytical approach employed will yield empirically verified performance projections for full-scale systems. The 1981 Operational Test Plan has been prepared defining tests in the Process Evaluation Facility (PEF) with the objectives of (1) characterizing the integrated fuel plant interactions and performance; (2) characterizing individual component performance; and (3) providing performance data for evaluation and verification of analytical models under development. A series of unfired dynamic tests along with fired steady state tests have been defined. Thermal decomposition of ammonia has been investigated experimentally and analytically. High conversion rates were observed for binary NH_3/H_2 gas mixtures; however, conversion was found to be thermodynamically limited when substantial H_2 and N_2 concentrations are present. The overall structure of the IGCC mathematical model has been developed and information flow requirements associated with each component in the model have been defined. The computer model for the gasifier and the first water quench have been completed.

31538 (DOE/ET/60058—T1, pp vp, Paper 6) **Coal desulfurization.** Knight, J.A.; Hurst, D.R.; Elston, L.W. (Georgia Inst. of Technology, Atlanta). 1980. NTIS, PC A07/MF A01.

In Cooperative program of applied energy research and technology development. Final technical report, October 1, 1979-December 31, 1980.

The purpose of this study was to explore the feasibility of partially desulfurizing pulverized coal by exposure to a heated stream of inert gas. The preliminary data from the free-fall experiments indicate that the technique is one that can yield useful and meaningful results on the desulfurization and volatilization of coal samples in a dilute phase mode. For example with the Kentucky coal using the free-fall apparatus, the results showed that the agglomerating characteristics of this particular coal had to be minimized to reduce the amount of material that would collect on the walls of the reactor. Samples of Kentucky coal were pretreated, as described in the Experimental Section. This treatment reduced the amount of material adhering to the reactor walls by approximately 50%. The data from preliminary experiment 6 with the Kentucky coal are indicative of the potential reductions in sulfur that can be obtained. If it is assumed that the sulfur components in the volatiles can be removed and that both the coke and the sulfur-free volatiles are used as a combined fuel, then the sulfur content of the original coal has been reduced by approximately 46 per cent. The data from the preliminary experiments with both the nontreated and treated Illinois coal indicated that the sulfur content, based on the assumptions above for the combined fuels, could be reduced significantly. The reduction with the nontreated coal was approximately 31 per cent, experiment 10, and with the treated coal was approximately 57 per cent, experiments 14 and 15. These data are sufficiently encouraging that this technical approach has promise as a method for the desulfurization of coal to acceptable levels.

31539 **(DOE/FC/02101—18) Chemistry of lignite liquefaction. Quarterly report, April-June 1981.** Baltisberger, R.J.; Stenberg, V.I.; Klabunde, K.J.; Woolsey, N.F. (North Dakota Univ., Grand Forks (USA)). Jul 1981. Contract AB18-78FC02101. 55p. NTIS, PC A04/MF A01. Order Number DE81030178.

Progress reports are presented for the following four tasks: structural studies of lignite-derived asphaltene and preasphaltenes; ether cleavage studies; studies of denitrogenation caused by CO and water reactions; and electron transfer catalysis studies. Some of the observations are: major differences between asphaltenes and preasphaltenes is that the molecular weight maximizes near 1500 g/mol for the preasphaltenes compared to 400 g/mol for the asphaltenes; asphaltenes have little or no aliphatic or aryl aliphatic ethers whereas preasphaltenes have significant amounts; asphaltenes have major amounts of diaryl ethers and smaller amounts of dibenzofurans while the reverse is true for preasphaltenes; there is a general decrease in diaryl ethers as the temperature of preparation is increased for both the asphaltenes and the preasphaltenes; for asphaltenes a corresponding increase in dibenzofurans is seen but for preasphaltenes these ethers are roughly constant with temperature; lack of cleavage of up to 54% of the ether originally present re-

mains a critical problem; the observed increase in molecular weight particularly with asphaltenes is inconsistent with the model structure and must be examined further; under reducing conditions at liquefaction temperatures, N,N-dimethylaniline gives the products: benzene, toluene, N-methylbenzylamine, N-methylaniline and aniline, H_2 is superior to CO-H_2O for the denitrogenation ofN,N-dimethylaniline into benzene; only the combined effect of the additives H_2S and HCO_2H can increase the yield of benzene and its reduction products; no electronic effect of the Ni/support catalyst on MgO was noted for hydrogenation, dealkylation, hydrogenolysis, dehydrogenation, except in the case of methanation.

31540 (DOE/PC/30291—3) Volatile production during preignition coal heating. Quarterly progress report, April 1981 - June 1981. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Jul 1981. Contract AC22-80PC30291. 18p. NTIS, PC A02/MF A01. Order Number DE81025485.

The goal of this program is to determine the characteristic pyrolysis behavior of representative coals under laser heating. The use of a CO_2 laser enables a controllable heating rate to be given to the coal particles as they pass through the laser beam. The development of such a laser heating diagnostic should prove to be an extremely valuable tool for generation of a data base necessary for the future design of coal burning facilities. The experimental configuration is illustrated. A dilute coal/gas stream, surrounded aby an inert shield flow is passed through a laser beam from an Avco HPL CO_2 laser. Under a prescribed flux density, and thus heating rate, the particle pyrolyse. The gaseous products are sampled and subsequently analyzed (primarily by gas chromatography) for carbon conversion. Particle temperature is to be monitored by a two-color pyrometer and particle velocity by laser Doppler velocimeter, by which means, evolution of the pyrolysis process can be determined.

31541 (DOE/PC/40770—T2) Kinetics and mechanisms of catalytic hydroliquefaction and hydrogasification of lignite. Quarterly report, April-June 1981. Kranich, W.L.; Gueruez, K.; Weiss, A.H. (Worcester Polytechnic Inst., MA (USA)). 10 Aug 1981. Contract FG22-81PC40770. 24p. NTIS, PC A02/MF A01. Order Number DE81023581.

The work reported in the Final Report for DOE Contract DE-AC22-77ET10618 has been continued under the current contract to expand the range of conditions previously studied. This has permitted a more detailed analysis of the variables involved in the hydroliquefaction and hydrogasification of lignite than was possible in the previous report. The principal progress has been a study of the catalytic batch hydroliquefaction of a range of low rank coals including two sub-bituminous coals, four lignites, and leonardite, as well as cellulose. These were studied both as received and after partial demineralization by washing with hydrochloric acid. The study is fully reported in the attached article which has been submitted for publication in a technical journal.

31542 (DOE/PC/41035—1) Liquefaction of bituminous coals using disposable ore catalysts and hydrogen. Quarterly progress report, May 7, 1981 - August 7, 1981. Mathur, V.K. (New Hampshire Univ., Durham (USA)). Aug 1981. Contract AC22-81PC41035. 17p. NTIS, PC A02/MF A01. Order Number DE81029134.

The objective of our research project is to study hydrogenation of coal-oil slurry by hydrogen using disposal ore catalysts (DOC) with special reference to maximizing liquefaction and minimizing viscosity of product oil. A number of companies were contacted to collect samples of ores and ore concentrates containing cobalt, molybdenum, nickel and other metals considered to posses catalytic activity for coal liquefaction. The results of initial experiments with no catalyst and a commercial Co-Mo catalyst (0402T) are reported. These data will be used as a base for evaluating the catalytic effects of the ores and minerals collected.

31543 (DOE/RA/50146—1) Alternative fuel for the steel industry of northern Indiana: a prefeasibility study of a central coal gasification project. (Northern Indiana Public Service Co., Hammond (USA); Bechtel Group, Inc., San Francisco, CA (USA)). May 1981. Contract FG01-80RA50146. 275p. NTIS, PC A12/MF A01. Order Number DE81029314.

A survey of the demand for natural gas by the Supporting Industry indicates a wide variation, from a low of 220 billion Btu per day to a high of 387 billion Btu per day. After an examination of the market demand, it was concluded that the synthetic fuels plant should be sized to produce 120 billion Btu per day of gas. The steel plants cover many hundreds of acres and have separate internal fuel distribution systems for gases with heat contents ranging from 80 to 1000 Btu per cubic foot. It would be extremely costly to install additional gas distribution systems and modify fuel burning equipment to accommodate a gas of different burning characteristics. Consequently, it was concluded that a medium-Btu gas should be produced that would have special properties to meet the requirements. A synthetic coke oven gas called SynCOG, can be used in the existing fuel distribution and combustion systems of the industry without major retrofit. The Lurgi and Texaco gasification processes were chosen as the basis for the study. The most significant environmental constraint will be air quality. Although the use of either process is feasible, NIPSCO selected the Texaco case for the development of the economics. A cash flow analysis indicates that the price of medium-Btu gas required to yield a 15 percent DCF return on equity is $5.67 per million Btu in 1981 dollars. This is approximately equal to the current price of imported oil. It is based on a 20-year financial analysis using a 3:1 debt to equity ratio and assumes an annual escalation in cost and gas price of 10 percent.

31544 (EPRI-AP—1932) Process development for improved SRC options. Kerr-McGee Critical Solvent Deashing and Fractionation Studies. Final report. Baldwin, R.A.; Davis, R.E.; Gillham, L.D.; Janka, R.C.; Leonard, R.E.; Rhodes, D.E. (Kerr-McGee Corp., Oklahoma City, OK (USA)). Jul 1981. 108p. NTIS, PC A06/MF A01. Order Number DE81903785.

The SRC-1/2 Process, a coal liquefaction process which includes Kerr-McGee Critical Solvent Deashing (CSD), was demonstrated in a blocked-out fashion in continuous bench-scale units. This work demonstrated that conventional SRC-I as well as Short-Residence-Time vacuum bottoms could be successfully deashed and fractionated and that the fractionated portion of the soluble coal product, Light SRC, could be added to liquefaction solvent to improve its quality. An amount of Light SRC equivalent to that which was initially added to liquefaction solvent was recovered in the CSD Process in most cases to maintain Light SRC recycle. Light SRC balance is dependent upon material balance restraints, along with limitations in the CSD Process to recover the Light SRC. However, these restraints were found to be satisfied over a wide range of liquefaction severities. Other CSD Bench-Scale work included studies directed toward increasing the recovery of soluble coal products and determining the operating restraints required to produce Light SRC. This work utilized feeds obtained from the Wilsonville SRC Pilot Plant. It was found that soluble coal product recovery was inversely proportional to the first-stage CSD temperature and that the fractionation step was sensitive to deashing solvent to feed ratio. The SRC-1/2 Process was not, however, fully integrated and therefore these results are not necessarily indicative of steady-state conditions. Integrated experiments are required to verify these findings.

31545 Structure-based kinetic model for carbonation of sulfided dolomite at elevated temperatures. Huang, C.S.; Rogan, F.H.; Li, K. (Carnegie-Mellon Univ, Pittsburgh, Pa). *AIChE (American Institute of Chemical Engineers) Symposium Series ;* 77: 1-10(1981). (CONF-801104—).

From 73. annual meeting of the American Institute of Chemical Engineers; Chicago, IL, USA (12 Nov 1980).

Cyclic use of dolomite is considered among the most promising high-temperature coal gasification desulfurization processes. In this study carbonation of sulfided dolomite in H_2O/CO_2 mixtures was investigated with particular emphasis on solid structure changes during reaction. The grains of sulfided pellets were found to consist of nonporous, nearly spherical nodules, several hundredths of a micron in diameter, which persisted during carbonation. A kinetic model including intranodular solid state diffusion and extranodular gas-phase diffusion is proposed. The reaction behavior falls into three kinetic regimes, distinguished by the interplay of the resistances to intranodular and intermodular diffusional processes, which in turn depend on temperature and conversion level.

31546 (IRT—19600/2) Materials-process-product analysis of coal process technology. Phase III, Task 2 report. Advanced gasification processes, Volume 1, results. Roig, R.W.; Jagota, A.K.; Soni, D.S. (International Research and Technology Corp., McLean, VA (USA)). 15 Oct 1979. Contract AC01-78ET12300. 40p. NTIS, PC A03/MF A01. Order Number DE81028222.

A Materials-Process-Product Model of coal-process technology has been developed for the US Department of Energy. This model is an application of a methodology, previously developed under a grant from the National Science Foundation, for systematically analyzing an array of competing manufacturing technologies from economic, environmental, and energy policy perspectives. This report includes material on expansion of the MPPM Data Base in the Area of Advanced Gasification Processes. Volume I summarizes the work done and presents results of some analyses that was accomplished using the new data base elements. Volume II contains detailed descriptions of the processes and process models added to the MPPM Data Base.

31547 (NBSIR—81-2191(DOE)) Use of the slow-strain-rate technique for the evaluation of structural materials for application in high-temperature gaseous environments. Johnson, C.E.; Ugiansky, G.M. (National Bureau of Standards, Washington, DC (USA). Center for Materials Science). Jan 1981. Contract AT01-77ET10694. 91p. NTIS, PC A05/MF A01. Order Number DE81029486.

Types 309, 310, 310S, 347 and 446 stainless steels, Incoloy 800, and Inconel 671 were tested at temperatures from 370 to 1040°C at strain rates from 10^{-4} to 10^{-7}/s in H_2S plus water, gaseous mixtures of CO, CO_2, H_2, CH_4, H_2S, and H_2O, and in nominally inert environments of He and Ar. Type 310 steel showed a marked reduction in mechanical properties at low strain rates ($< 10^{-5}$/s) in H_2S/H_2O at 540°C, and this was associated with the occurrence of a large degree of secondary intergranular cracking in addition to the main ductile fracture mode. The occurrence of the secondary cracking was taken as the primary indication of embrittlement in subsequent tests. It occurred to some degree in all alloys tested in the simulated coal-gasification environments at 600°C. The mechanism(s) of the embrittlement phenomena remain uncertain; a number of possible causes including creep and several environmentally-induced fracture processes are outlined. It is shown that the overall results of the test program are in good agreement with in-plant experience.

31548 (PNL-SA—9516) Carcinogenic effects of coal-conversion materials. Renne, R.A.; Smith, L.G. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 29p. (CONF-801143—2). NTIS, PC A03/MF A01. Order Number DE81028108.

From Industrial hygiene and occupational medicine in coal conversion projects workshop; Washington, DC, USA (7 Nov 1980).

Portions of document are illegible.

Tremendous expense and extensive time commitments are required for in vivo mammalian carcinogenesis tests. Regulatory agencies may not be completely satisfied without some repetition of the toxicity testing with the final product from the commercial plant. Nevertheless, I think the work that we are doing on these materials from the pilot and demo plants is valuable. We are attempting to determine the correlation between mutagenesis and carcinogenesis data on complex mixtures such as these synfuel materials. The heavy distillate that we are working with was highly mutagenic compared with the other materials tested in the Ames system; it was also highly carcinogenic in our mouse skin-painting assay. When we tested the fractions, we had somewhat different results from those of the mutagenesis assays: the basic fraction of the heavy distillate was highly mutagenic but, at least now, it does not appear to be highly active in our mouse carcinogenesis assay. However, the basic tar and the neutral tar skin carcinogenesis data correlate fairly well with the mutagenesis data. The second point I would like to make is to emphasize the need for caution against depending heavily on equating PNA content with carcinogenic activity. I would like to point out that our data indicate that PNAs are not the only chemical group with which we should be concerned. We should also monitor for primary aromatic amines. Due to the concern inhalation of synfuels, we have begun inhalation studies on some of the SRC materials.

31549 (SAND—81-0715C) Catalytic effect of iron in hydrogasification of coal. Padrick, T.D.; Dees, D.D.; Massis, T.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 9p. (CONF-811014—2). NTIS, PC A02/MF A01. Order Number DE81023928.

From 11. North American Thermal Analysis Society conference; New Orleans, LA, USA (19 Oct 1981).

Hydrogasification of coal is a technique to produce synthetic natural gas (SNG), which offers the advantage of methane production in a single process step. A fundamental limitation of hydrogasification is the low reactivity of hydrogen compared to steam or oxygen, towards coal chars. Utilization of a low-cost catalyst which would greatly enhance the reactivity of hydrogen towards coal char would significantly impact the SNG program. While investigating mineral matter effects in coal gasification, we observed that finely divided hematite enhances the production of methane, by a factor of fifteen, during char gasification at one atmosphere of hydrogen. Gasification rates are measured by heating the samples in a thermal gravimetric analysis (TGA) system to a fixed temperature and then monitoring the rate of weight loss versus time. Product gas analysis indicates that during char gasification with hematite present, greater than 85 mole % of the gas is methane. The catalytic form of the hematite has been identified as reduced iron. The effect of the reduced iron as a catalyst is strongly dependent on particle size. The catalytic activity is also dependent on precursor species with the following order observed: $Fe_2O_3 > Fe_3O_4 > FeS_2 > Fe$.

31550 (TVA/OGM/CG—81/6) Conceptual design and assessment of a coal-gasification commercial demonstration plant. Volume 1. Koppers-Totzek gasifier. Final report. (Bechtel National, Inc., San Francisco, CA (USA)). Sep 1980. 392p. NTIS. Order Number DE81903580.

Objective is to demonstrate the operation of a commercial-scale coal gasification facility producing clean medium-Btu gas (MPB). The facility will convert ~ 20,000 tons/d of bituminous coal into ~ 300 billion Btu/d of MBG. The process choice was narrowed down to the Texaco and Koppers-Totzek processes. This report presents the results of Bechtel's conceptual design and techno-economic assessment of the Koppers-Totzek process. (DLC)

31551 (TVA/OGM/CG—81/8) Conceptual design and assessment of a coal-gasification commercial demonstration plant. Volume 3. Summary. (Bechtel National, Inc., San Francisco, CA (USA)). Sep 1980. 159p. NTIS. Order Number DE81903581.

Objective is a commercial-scale coal gasification facility producing clean medium-Btu gas (300 billion Btu/day) from 20,000 tons/day of bituminous coal. The process was narrowed down to either the Texaco process, the Koppers-Totzek process, or a combination of those two. This document is a summary description of the plants for both processes. Brief summary tables are presented for comparison. (DLC)

31552 (TVA/OGM/CG—81/9) TVA coal-gasification plant conceptual design. Volume 1. Plant based on Executive overview (Summary). Final report. (Foster Wheeler Energy Corp., Livingston, NJ (USA)). 1 Nov 1980. 86p. NTIS, PC A05/MF A01. Order Number DE81903994.

TVA plans to build a coal gasification plant to demonstrate the operation of a commercial scale coal gasification facility producing a clean medium Btu gas (MBG) for use in various industrial applications in the TVA region. In the Phase I efforts, Foster Wheeler Energy Corporation prepared conceptual designs, cost estimates, and trade-off studies of the following gasification systems: Lurgi Dry Bottom, Koppers-Totzek, Babcock and Wilcox, British Gas Slagger, and Texaco.

31553 (TVA/OGM/CG—81/10) TVA commercial demonstration plant project. Volume 2. Basis of study assessments and project selection. Final report. (Foster Wheeler Energy Corp., Livingston, NJ (USA)). 1 Nov 1980. 247p. NTIS, PC A11/MF A01. Order Number DE81903993.

The Tennessee Valley Authority (TVA) is considering the design, construction, and operation of a commercial scale coal gasification facility to produce a clean, medium Btu fuel gas (MBG). The project includes all process and support systems required to convert approximately 20,000 tons per day of Kentucky No. 9 bituminous coal, as fed to the gasifiers, into MBG equivalent to about 300 billion Btu per day. The first phase of the proposed project involves conceptual design, environmental and siting studies and economic analyses of commercial plants emphasizing the following gasification technologies: Babcock and Wilcox entrained flow gasifier, Lurgi dry ash gasifier, BGC/Lurgi slagging gasifier, Texaco entrained flow gasifier, and Koppers Totzek entrained flow gasifier. Foster Wheeler's study and assessments/process selection is summarized in this volume.

31554 **(TVA/OGM/CG—81/11) TVA commercial demonstration plant project. Volume 4. Plant based on Babcock and Wilcox gasifier. Final report.** (Foster Wheeler Energy Corp., Livingston, NJ (USA)). 1 Nov 1980. 206p. NTIS, PC A10/MF A01. Order Number DE81903992.

The baseline design of a coal gasification plant producing medium Btu gas, based upon the Babcock and Wilcox gasification process is documented in this report. The coal gasification plant consists of four identical modules, each with a capacity of approximately 5000 tons of coal per day as delivered to the gasifiers. The entire plant (four modules) produces 1205.7 MCFD of gas with a GHV value of approximately 299 Btu/SCF for a total heating value of about 360 billion Btu/day. The plant location is the rural site of Murphy Hill, located along the Tennessee River, some 30 miles east of Huntsville, Alabama. The desired product gas is a clean, medium-Btu gas suitable for pipeline distribution. The coal used for processing and for auxiliary boilers is a Kentucky No. 9 coal. The site is accessible by barge and road, with the plant receiving coal primarily by barge. Water needed for cooling and for process consumption will be drawn from the Tennessee River and will be treated by the plant water treatment facility. A description of the plant by major sections is included as well as flow diagrams, stream balances and lists of major equipment. Estimates of emissions and effluents are presented.

31555 **(UCRL—85906) Coal-block-gasification experiments: laboratory results and field plans.** Thorsness, C.B.; Hill, R.W. (Lawrence Livermore National Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 22p. (CONF-810923—8). NTIS, PC A02/MF A01. Order Number DE81028423.

From 7. underground coal conversion symposium; Fallen Leaf Lake, CA, USA (8 Sep 1981).

The ability to visually inspect in situ gasification cavities has hindered our understanding of the process. As a step in overcoming this problem, laboratory-scale steam/oxygen gasification of 300-kg coal blocks were performed using an initial drilled link. At the end of the experiments the cavities were examined. For the three coals studied (Wyodak, Hanna, and WIDCO), the cavities were quite different, yet the product-gas heating values were similar. Detailed results of these tests are presented. Concern over the ability to scale small experiments to a large field system led to a proposal to perform intermediate-scale tests at an exposed coal face. The test plan for the first intermediate-scale tests, to be performed at the WIDCO mine site, is outlined.

31556 **(UCRL—86518) Mathematical modelling of some chemical and physical processes in underground coal gasification.** Creighton, J.R. (Lawrence Livermore National Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 5p. (CONF-811027—1). NTIS, PC A02/MF A01. Order Number DE81027941.

From Eastern section: the combustion institute conference; Pittsburgh, PA, USA (27 Oct 1981).

Underground coal gasification normally involves two vertical wells which must be linked by a channel having low resistance to gas flow. There are several ways of establishing such linkage, but all leave a relatively open horizontal hole with a diameter on the order of a meter. To increase our understanding of the chemical and physical processes governing underground coal gasification LLNL has been conducting laboratory scale experiments accompanied by mathematical modelling. Blocks of selected coal types are cut to fit 55 gallon oil drums and sealed in place with plaster. A 1 cm. diameter hole is drilled the length of the block and plumbing attached to provide a flow of air or oxygen/steam mixture. After an instrumented burn the block is sawed open to examine the cavity. Mathematical modelling has been directed towards predicting the cavity shape. This paper describes some sub-models and examines their impact on predicted cavity shapes.

31557 **Coal gasifier slurry feeding systems with pressurized dewatering.** Funk, E.; Barrett, M. pp 222-227 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In 1950 Kamyr installed their first commercial Continuous Hydraulic Digester for making pulp from wood chips. A very important part of the overall system was the feeding system used to feed the wood chips into the digester vessel which operated at 225 PSI and 250°F. The feeding system has two criteria to meet; it had to be continuous and it had to be hydraulic. Today more than 132,500 air dried tons per day of wood pulp are produced through Kamyr systems worldwide, or 60% of the wood pulp produced in the world. In 1975 Kamyr, Inc. in cooperation with Island Creek Coal Company, installed a pilot feeding system to test this feeding system on coal. In 1979 Kamyr, Inc., in cooperation with the British National Coal Board, installed a pilot feeding system to feed wash plant refuse into a pipeline. The feeding system needs operate at only 80 PSIG. The pilot facility is being used to test a commercial system. These tests include changing the materials of construction of system components for increased wear life and corrosion protection. The transport medium is a brine 4 to 7 times saltier than sea water. Kamyr, Inc., is also developing feeding systems to feed coal and oil shale gasifiers. We have not as of yet pilot tested one of these systems, but feel that they will be the key to developing gaisifers of larger capacities.

31558 **(DOE/ET/13060—T5) Phase I: the pipeline gas demonstration plant. Foundation investigation and soil analyses report.** DiFulgentiz, R.A. (ed.). (Continental Oil Co., Stamford, CT (USA); Ackenheil and Associates Geo Systems, Inc., Pittsburgh, PA (USA)). [nd]. Contract AC01-77ET13060. 197p. (FE—2542-19). NTIS, PC A09/MF A01.

Contract No. EF-77-C-01-2542 between Continental Oil Company and the United States Department of Energy (DOE) requires Continental Oil Company to analyze, design, construct, test, evaluate, and operate a Demonstration Plant capable of converting high-sulfur bituminous caking coal to a high-Btu pipeline quality gas. One of the assignments under the contract is to obtain data on the selected plant site. Part of the required site data consists of a reconnaissance soil survey. A site consisting of about 1245 acres has been selected in Noble County, Ohio, by Continental Oil Company. This site lies in portions of Sections 3, 10, and 15 of Marion Township and portions of Sections 9 and 16 of Center Township. These contiguous portions are available as a single property from Consolidation Coal Company, the owner. The Foundation Investigation and Soil Analyses Report presents data and opinions on the soil, rock, and ground water conditions at test boring locations throughout the plant site. The report also presents general recommendations for fill areas, cut areas, and construction. The selected site was found to be suitable for constructing the Demonstration Plant, but a considerable amount of earth work and site leveling will be necessary.

0105 By-products

REFER ALSO TO CITATION(S) 31565

0106 Properties

REFER ALSO TO CITATION(S) 31539, 31586, 32294, 32300

31559 (BMI—2086) Thermophysical properties of coal liquids. Seventh quarterly technical status report, April 1-June 30, 1981. Droege, J.W.; Venkateswar, R.; Chauhan, S.P. (Battelle Columbus Labs., OH (USA)). 17 Jul 1981. Contract AC22-79ET14941. 40p. NTIS, PC A03/MF A01. Order Number DE81027946.

Measurements of rheological properties have been continued. Measurements at relatively low temperature (450 K) showed that a coarser coal grind shows substantially lower viscosity. It was also shown that coal and solvent obtained from the Fort Lewis plant give slurries of much higher viscosity than slurries from our reference coal and solvent. At higher temperatures (540 K) substantially the same relationships were shown. The effect of solvent-to-coal ratio was also found to be very great. Differential scanning calorimetry gave some low reliability specific heat results and showed indication of a probable heat effect at about 500 K. No indication of exothermic reaction with hydrogen was found.

31560 (DOE/ER/10339—T1) Metal-ammonia reduction and reductive alkylation of coal tar hydrocarbons and the ^{13}C NMR characterization and conformational analysis of the reduced products. Progress report, December 18, 1978-December 31, 1981. Rabideau, P.W. (Purdue Univ., Indianapolis, IN (USA)). Jun 1981. Contract AC02-793410339. 9p. NTIS, PC A02/MF A01. Order Number DE81028484.

Progress has been good and has led to a much better understanding of alkali metal reduction processes. Major areas are as follows: (1) Reaction Conditions and Structural Types. Information about the nature of the anionic intermediates (radical anions, monoanions, dianions) has led to an improved method for selecting reaction conditions. (2) Reductive Alkylations. This Sternberg alkylation type process has been investigated with naphthalene and anthracene. (3) Conformational Analysis. Molecular mechanics calculations have been carried out for the reduced hydrocarbons and have produced unexpected results. (4) Protonation Sites in Dianions. Recent results challenge the concept of charge density for predicting protonation sites in dianions.

31561 (DOE/ET/10482—T2) Development of instrumental methods of analysis of sulfur compounds in coal process streams. Quarterly technical progress report, April-June 1981. Jordan, J.; Stahl, J.; Yakupkovic, J.E. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). Jul 1981. Contract AC22-77ET10482. 28p. NTIS, PC A03/MF A01. Order Number DE81027936.

This report covers the seventh quarter of a two-year contract renewal period. Task 1: extension and refinement of thermodynamic survey and construction of pourbaix diagrams. Work has been completed on schedule and has previously been reported in FE-10482-14 (1981). Task 2: voltammetric methods development. The hydrososulfide moiety HS^- is not electroreducible at the dropping mercury electrode. A mixture of HS^- and of the polysulfide anions S_6^{-2}, S_4^{-2}, S_3^{-2} yielded a complex polarogram which included a narrow limiting current domain. That current provided a linear measure of the quantity [S/sub x^{-2}] = $[S_6^{-2}] + [S_4^{-2}] + [S_3^{-2}]$. Tack 3. enthalpimetric methods development. Assignments of heats of precipitation and solubility products of Tl_2S, Tl_2S_2, Tl_2S_3, Tl_2S_4, and Tl_2S_5 have been compiled from the literature. The molar sum of sulfide and polysulfides has been determined by precipitation titration to a thermometric endpoint with standard thallous nitrate. Task 4. application and technology transfer to coal conversion plants. A polarographic method for determining polysulfides has been validated in a coal liquefaction process stream. The relevant polarographic reduction wave is specific for moieties of the type S/sub x^{-2}. The hydrosulfide ion HS^- did not interfere. No cathodic sulfide waves were seen in an H-Coal sour water sample which contained HS^- but no polysulfides.

31562 (DOE/EV/10403—5) Applicability of factor analysis to the determination of mineral matter in coal. Roscoe, B.A. (Illinois Univ., Urbana (USA)). 1981. Contract AC02-80EV10403. 202p. NTIS, PC A10/MF A01. Order Number DE81030155.

A method for determining the characteristics of the mineral matter in coal was developed based on two types of factor analysis. Classical factor analysis was shown to identify trends in data sets that are indicative of the mineral phases and data errors. If a data error was identified by classical factor analysis, appropriate corrective action produced a data set with only experimental errors present that could be used for further analysis. Target transformation factor analysis (TTFA) was then used to quantitatively identify the elemental distribution of the minerals in coal. An iterative approach to TTFA was developed and demonstrated to identify mineral phases without prior information concerning the phases. Techniques to estimate the uncertainties associated with the reproduction of the data by factor analysis were also studied. To evaluate the ability of TTFA to resolve sources, it was applied on four sets of data: a previously resolved set of geological data, a set of artificially prepared data, a set of coal data from the Upper Freeport coal bed, and a set of coal data from an Illinois coal mine. The results obtained from the geological data and Upper Freeport data compared favorably with results obtained by other methods while the results obtained with the artificial data compared favorably with known values. Studies on the Illinois coal samples indicated that representative elemental profiles may be obtained for an individual mine with minimum requirements for sampling and sample preparation. In addition, it was indicated that one may get local geological variation in a single coal bed sampled at various locations; thus, in general, factor analysis of samples obtained from a localized area will yield data sets that are more meaningful.

31563 (DOE/RI-PMTC—11-81) Analysis of tipple and delivered samples of coal collected during Fiscal Year 1980. Report of investigations. Welsh, R.A. (Department of Energy, Washington, DC (USA). Assistant Secretary for Fossil Energy). May 1981. 19p. NTIS, PC A02/MF A01. Order Number DE81001237.

This Department of Energy (DOE) publication updates a series of Reports of Investigation on the quality of coal purchases under specifications for Government use. Listed in alphabetical order by state, county, town, and mine are analytical data on the composition and quality of tipple and delivered samples of coal collected during fiscal year 1980. Tipple samples were collected by a commercial laboratory under contract in accordance with instructions furnished by the Coal Sampling and Inspection Office (CSIO). The delivered samples were collected at destination by installation personnel, and all samples were analyzed in the DOE laboratory located in Pittsburgh, PA.

0108 Waste Management

REFER ALSO TO CITATION(S) 31576, 32409, 32466

31564 (LA—8929-MS) Chemical element concentrations in liquids and solids associated with power plants using FGD systems. Wangen, L.E.; Jones, M.M. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01. Order Number DE81030422.

Solid and liquid process steam samples from eight power plants using wet flue gas desulfurization (FGD) scrubbers have been analyzed for the trace elements As, B, Br, Cl, Cd, Co, Cr, F, Ga, I, Mo, Ni, Pb, S, Sb, Se, Th, U, V, W, and Zn as well as several major and minor elements. Four plants burned high-sulfur coals and three burned low-sulfur coals. One plant used a low-sulfur lignite coal. Four FGD systems used limestone, two used lime, and two used alkaline flyash as scrubbing reagent. Elemental concentration data were used to identify chemical elements of concern regarding their potential for causing environmental harm as a result of the disposal of residues associated with FGD systems. Elemental concentrations were evaluated by the Environmental Protection Agency's minimum acute-toxicity-of-effluents criteria. Calcium, Mg, Mn, Ni, Se, and SO_4^{2-} were identified as most generally problematic. The elements B, Cd, F, and Mo were judged as potentially problematic in certain situations. Generally FGD liquors from power plants that burned low-sulfur western coals had highest concentrations of most trace elements.

31565 (PB—81-106676) Metals recovery from post combustion coal ash. Report for November 1978-1979. Aldrich, R.G. (Halomet, Inc., Manlius, NY (USA)). Nov 1979. 61p. NTIS, PC A04/MF A01.

This report detailed the results of an investigation into the applicability of fluorine-based separation for the commercial recovery of metal values from fly ash produced in electric utility boilers fired by coal. The study dealt principally with the extraction of aluminum.

31566 **Coal pile leachate quality.** Davis, E.C.; Boegly, W.J. (ORNL). *Journal of the Environmental Engineering Division, ASCE (American Society of Civil Engineers)* ; **107**: No. 2, 399-417(Apr 1981).

Coal type, size, and storage technique are three important factors that determine storage pile leachate quality. A factorial experimental design including all possible combinations of these three factors was used for 119 days with nine simulated rainfall events. Coal type was significant as it determined the amount of available pollutants that may be leached. Coal particle size and storage technique were of little importance during the first rainfall, but became increasingly important in influencing leachate quality as the number of rainfall events increased.

31567 **Outside bag collectors on industrial boilers.** Bundy, R.P.; Plunkett, T.P. Kansas City, MO; Standard Havens, Inc. (1981). 20p. (NP—1904114).

Fabric filters have not reached a state of maturity that has allowed precise evaluation of each of the alternative design conditions; however, they have reached a level that if one is willing to search for similarities in their operation with systems that are already running and if common sense is used in analyzing differences between different applications, one is able to arrive at a conservative workable design for any given application. It must be borne in mind, however, that the equipment supplier's goal is to sell their equipment with only a reasonable risk of liability, whereas it is the buyer's goal to buy the most cost-effective equipment he can that meets his needs for reliability. Although both goals are in general similar, there are certainly distinct differences and, with the amount of the analysis that must be subjective, one must constantly be on guard to maintain objectivity and to seek it in others connected with the project to be sure that the assumptions are reasonable and supported by the operating experience that exists.

31568 **Hydraulic disposal of colliery waste material.** Onley, J.K. pp 120-126 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The work to date has proved that solid waste can be pumped to the beach successfully. it has yet to be proved that satisfactory dispersal at sea can be achieved with an offshore pipeline. The Kamyr feeder is preferred to solids handling pumps provided that its wear life can be improved to an acceptable level. The section of pipe material requires the most careful attention and is dependent upon the interaction of a number of factors particular to the installation. It seems likely that in the present stage of our knowledge pipelining will offer an economic alternative to overland transport and barging out to sea.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 31558, 31578, 31617, 31661, 31795, 32412, 32564, 32566, 32584

31569 **(CONF-810855—1) Coal conversion solid waste disposal.** Francis, C.W.; Boegly, W.J. Jr.; Turner, R.R.; Davis, E.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE81028567.

From American Society of Civil Engineers annual meeting; Vail, CO, USA (3 Aug 1981).

The major solid waste produced at coal conversion facilities will be gasification slag or ash. To evaluate the impact of this waste on the environment, the Oak Ridge National Laboratory conducted extensive characterization and leaching studies on ash/slags that had been generated in bench-scale operations, pilot plants, and/or process development units for the Cogas, British Gas/Lurgi, Grace/Texaco, U-Gas, Foster Wheeler/Stoic, SRC-I/Koppers-Totzek, SRC-II/Texaco, and Combustion Engineering gasification processes. These studies, designed to assess the consequences of disposal in landfills, showed that none of the leachates from these eight wastes exceeded the US Environmental Protection Agency's toxicity limits established as a result of the Resource Conservation and Recovery Act of 1976. Thus, these ash/slags would be classified as nonhazardous wastes. Quantities of polynuclear aromatic hydrocarbons (PAH) that were observed in the aqueous leachates of selected ash/slags were less than 1 μg/g and appear to be of no significant environmental concern. Column elution studies revealed effluents with pH values less than 3 and sulfate concentrations greater than 10,000 mg/L for wastes containing sulfur concentrations from 0.3 to 4%. As a result, the major environmental impact associated with disposal of these solid wastes appears to be the dissolution of sulfate and the potential acidification of ground water.

31570 **(DOE/EIS—0007-D) Low-Btu coal-gasification facility and industrial park, Georgetown, Kentucky. Draft Environmental Impact Statement.** (Department of Energy, Washington, DC (USA)). Apr 1978. 405p. NTIS, PC E05/MF E05. Order Number DE81029871.

This draft Environmental Impact Statement (EIS) evaluates the potential environmental impacts which may be associted with the construction and operation of a low-Btu coal gasification facility and the attendant industrial park in Georgetown, Scott County, Kentucky. Impacts were examined on 2 levels, those resulting from construction and those resulting from operation. Impacts from both the gasifier and the industrial park were identified in relation to the physical, biological, and socioeconomic environments. Mitigation of potential adverse effects from both construction and operation of the facility was discussed and unavoidable adverse effects were identified. (DMC)

31571 **(DOE/ET/13046—1) Memphis Light, Gas and Water Division Industrial Fuel Gas demonstration project: Memphis, Shelby County, Tennessee. Final environmental impact statement.** (Memphis Light, Gas and Water Div., TN (USA)). May 1981. Contract AC02-77ET13046. 643p. NTIS, PC A99/MF A01. Order Number DE81030147.

The statement assesses the potential environmental impacts associated with the construction and operation of a 3155-ton/d capacity facility, which will demonstrate the technical operability, economic viability, and environmental acceptability of the MLGW coal gasification plant at Memphis, Tennessee. Impacts addressed include potential impacts on terrestrial and aquatic ecology, including state and federally declared threatened or endangered species; expected impacts on land use; projected alteration of flood elevation; potential changes to the quality of surface water and groundwater; compliance with state and federal ambient air quality standards; and changes to existing economic and social characteristics of the site area. Additionally, the statement presents an identification of potential hazards associated with the operation of the proposed facility. MLGW's monitoring plan for the duration of the demonstration phase to assess the effectiveness of the planned mitigation measures is also presented.

31572 **(PB—81-104747) The environmental impact of coal transfer and terminal operations. Final report December 1978-December 1979.** Pelham, L.; Abron-Robinson, L.A.; Ramanathan, M.; Zimmora, D. (Hampton (Delon) and Associates, Silver Spring, MD (USA)). Oct 1980. 88p. NTIS, PC A05/MF A01.

This study was conducted to assess current environmental impacts, and to define potential control technology that will minimize the pollution resulting from coal transfer/terminal operations. Environmental impacts from coal transfer/terminal operations can be lessened by employing proper control methods, which should be incorporated into the early states of planning and design. Coal transfer is an expanding technology, and the construction, operation, and closure/abandoment of new transfer facilities should be monitored and reported. In addition, experiences related to the transfer of western coals should be monitored and reported, since a limited amount of experience has been reported on the handling of these coals.

31573 **(PB—81-105827) Water quality modelling of mine acid drainage. Water resources and environmental engineering research report (interim).** Uchida, A. (State Univ. of New York, Buffalo (USA). Dept. of Civil Engineering). Aug 1979. 228p. NTIS, PC A11/MF A01.

Two steady-state, one-dimensional water quality models applicable to the streams receiving mine drainages are presented. The first model assumes chemical characteristics of the stream waters to be represented by the system of aqueous carbonate-sulfate equilibria. The exchange of carbon dioxide across the air-water interface was assumed to be the only significant sink-source of inorganic carbon. Essential aspects of the model were tested in a bench-scale laboratory experiment. A comprehensive model is then presented which takes into consideration kinetics of ferrous iron oxidation, growth and decay of iron-oxidizing bacteria, and interfacial exchanges of oxygen ad carbon dioxide, as well as chemical precipitation-dissolution reactions. The aqueous chemical system is modelled for forty-two species that are commonly present in mine drainage waters.

31574 **(PB—81-108078) Source assessment: dry bottom utility boilers firing pulverized bituminous coal. Final report May 1974-August 1980.** DeAngelis, D.G.; Reznik, R.B.; Ruffin, D.S.; Rigano, J.N.; McCurley, W.R. (Monsanto Research Corp., Dayton, OH (USA)). Oct 1980. Contract EPA-68-02-1874. 210p. NTIS, PC A10/MF A01.

The report describes and assesses the potential impact of air emissions, wastewater effluents, and solid wastes from dry-bottom utility boilers firing pulverized bituminous coal. Consuming about 320 million metric tons of the coal per year, this is the primary method of firing coal in utility boilers. Air emissions were characterized from literature data, supplemented by field sampling. Significant emissions from coal combustion were particulate matter, SOx, NOx, hydrocarbons, polycyclic organic materials, and a number of elements emitted as particles and vapors. The potential environmental impact of each emission species (after passing through state-of-the-art controls) was individually assessed using a calculated quantity known as ambient source severity (the ratio of the maximum ground level concentration--determined through dispersion equations--to an ambient environmental goal). No species were found to have an ambient source severity greater than 1.0; NOx (0.97) and SOx (0.93) had the highest severities. It was estimated that the human population around an average source in this category exposed to an ambient severity greater than 0.05 was about 300,000 persons for NOx and SOx. Pollutant concentrations were also determined in wastewater and solid waste streams. Effluent source severities and solid waste discharges were both found to be minor, with controls.

31575 **(PB—81-134215) Lime helps establish crownvetch on coal-breaker refuse. Forest Service research paper (final).** Czapowskyj, M.M.; Sowa, E.A. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1976. 11p. NTIS, PC A02/MF A01.

Lime, fertilizer, and mulch were tried on anthracite coal-breaker refuse in attempts to establish a ground cover of crownvetch. Lime had an effect after 7 years and is considered essential for establishing crownvetch on these highly acid sites. Fertilizer had little effect on survival but enhanced establishment of ground cover. Mulch also provided some benefit. Chemical characteristics of the refuse were improved on areas that received lime and fertilizer treatments.

31576 **Environmental control technology for contaminated coal refuse drainage.** Wewerka, E.M.; Gottlieb, M.; Grua, C. (Los Alamos Sci Lab, NM). *Mining Engineering (New York)*; **33**: No. 4, 416-420(Apr 1981).

The control methods under consideration include chemical and physical methods to immobilize or remove undesirable contaminants prior to refuse disposal, treatment of refuse disposal sites with attenuating agents to prevent the discharge of contaminated water, and direct treatment of refuse drainage as it emerges from the disposal site. 8 refs.

0110 Reserves And Exploration

31577 **(PB—81-851362) Seismic surveys for coal. January, 1976-September, 1980 (citations from the Energy Data Base). Report for Jan 76-Sep 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 113p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning seismic surveying instruments and techniques used in prospecting for coal deposits for mining or gasification. Results of seismic surveys for coal deposits at specific locations throughout the world are also included. (Contains 112 citations.)

0120 Mining

31578 **(ANL/LRP—1) Selective bibliography of surface coal mining and reclamation literature. Volume 3: Western Coal Provinces.** Daniels, L.K.; Boyd, C.A.; Daniels, T.F.; Kann, H.A. (Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 201p. NTIS, PC A10/MF A01. Order Number DE81030094.

This bibliography has been compiled for use by researchers, students, and other groups who need a reference source of published literature related to surface coal mining and reclamation in the Western Coal Provinces. This bibliography contains more than 1000 references, including government reports, journal articles, symposium proceedings, industrial reports, workshop proceedings, theses, and bibliographies. A simple format was used to categorize citations.

31579 **(CONF-810714—2) Longwall mining of thin seams.** Curth, E.A. (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Mining Technology Center). 1981. 22p. NTIS, PC A02/MF A01. Order Number DE81028042.

From Conference on ground control in mining; Morgantown, WV, USA (27 Jul 1981).

Thin seam operations pose a challenge to the ingenuity of mining engineers to overcome the factor of human inconvenience in the restricted environment and associated high cost production. Surprisingly, low seam longwalls in the Federal Republic of Germany in an average thickness of 35 in. and dipping less than 18° come close to achieving the average production rate of all German longwall operations. They are all plow faces, and a consistent production of 3300 tons per day and a productivity of 40 tons per man shift are reported from one of the thin seam longwalls. These results were attained by reliable high-capacity equipment and roof support by shields that can be collapsed to as low as 22 inches. Maximum mining height for plow operated faces lies at 31.5 inches. Technology for mechanized mining of flat lying coalbeds less than 31.5 inches in thickness without rock cutting is not available, and firmness of coal, undulation of the strata, coalbed thickness variation, and the necessity of cutting rock, particularly through faults, set limits to plow application. The in-web shearer can be used in firm coal to a minimum mining height of 40 inches, and a daily production of 1650 to 2200 tons is reported from a longwall in the Saar district of Germany equipped with such a shearer and shields. Numerous in-web shearers are employed in the United Kingdom; reports as to their success are contradictory. Also, experience in the United States, though limited, has been negative. The steady increase in output from single drum shearer faces in Pennsylvania is a remarkable achievement, and occasional record breaking peaks in production indicate the potential of such mining. Technology development for the future is discussed.

31580 **(PB—81-109415) User's manual for premining planning of eastern surface coal mining. Volume 2. Surface mine engineering. Final report June 1975-July 1978.** Ramani, R.V.; Bise, C.J.; Murray, C.; Saperstein, L.W. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Engineering). Oct 1980. 374p. NTIS, PC A16/MF A01.

A comprehensive summary of the analyses required to layout a surface mine, taking into consideration the limitations imposed by geology, equipment, reclamation, economics, and environmental control requirements is provided. Methods, techniques, and alternatives are recommended for selecting and designing mining

systems that include soil handling and storage, overburden removal, and minimization of environmental effects of drilling, blasting, off-highway transportation, coal loading, and steep slopes.

31581 **(PB—81-125528) An interactive computer system for evaluating coal mine illumination. Open file report (final) Oct 77-Dec 79.** Goldstein, R. (Mathematical Applications Group, Inc., Elmsford, NY (USA)). Mar 1980. Contract S0271041. 21p. NTIS, PC A02/MF A01.

A computer system for calculating the illumination on coal mine surfaces due to machine-mounted lights is described. Utilizing numerical models of mining machinery and measured data on luminaire output characteristics, the program computes the foot-candle levels incident on the mine entry surfaces for any desired machine-luminaire-entry configuration. Shadowing effects of the machine are taken into account. Results are provided at 2-foot intervals on the face, left and right walls, floor, and roof. The system operates interactively from a Tektronix 4014 graphics terminal which handles all input-out functions. The software is installed on a Cyber 74 computer that communicates with the terminal by a telephone line.

31582 **(PB—81-130858) Interactive mine-power-system analysis--APL fault program. Open file report (final) 30 May 78-14 Feb 79.** Trutt, F.C.; Morley, L.A.; Rivell, R.A. (Pennsylvania State Univ., University Park (USA)). 1 Mar 1979. 109p. NTIS, PC A06/MF A01.

A guide to the development and utilization of an interactive mine-power-system fault program is presented. Theoretical foundations and implementation considerations are discussed with respect to the mine-power system. Alternative Kron reduction techniques are presented along with a triangular-storage method for storage conservation. Program capabilities include the analysis of balanced and unbalanced fault situations using symmetrical component theory. To account for phase shifting in delta-wye transformers and zero-sequence network constructions, transformer and load configurations are specified. The positive- and zero-sequence connections needed for network conformity are automatically constructed with the required impedances.

31583 **Design and development of a hydrotransport face haulage system using a self regulating dry feed injector and ventilated boost pumps.** Burnett, M.; Harvey, A.C.; Rubin, L.C. pp 144-150 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In any hydraulic haulage pipeline facility, the transient or time dependent flow situations are usually the most influential and complex parameters controlling the slurry system's design. Failure to properly deal with these flow transients usually results in water hammer and/or cavitation which can prematurely destroy equipment. To date, hydraulic haulage has succeeded primarily where relatively steady state flow conditions can be maintained by use of sumps and batching techniques or where sophisticated electronic controls can monitor and adjust system parameters. FMA, under contract to the Department of Energy, has developed for the purpose of hydraulic haulage, a coarse solids injector pump and offspring boost pump. Both pumps are self controlling and self regulating and thereby require no sumps, batching techniques or electronic controls to handle flow transients. Test results, theory and cost comparisons have shown that a hydraulic transport system consisting of a ventilated helical inducer injector and one or more helical inducer boost pumps spaced at appropriate intervals, can be a viable alternative to a system of mixing tanks/sumps, centrifugal pumps and variable speed drives. The FMA system is especially suited for those applications wich necessitate a continual expansion of the transport distance (tunneling, mining, etc.). This injector pump is kept near the operating face and boost pumps is kept near the operating face and boost pumps are added where needed without effecting system response and control requirements. This hydraulic haulage system can be best summarized by the following characteristics: Pumps operate at a constant speed; pumps operate at a constant water flowrate; pumps operate at a variable solid flowrate; no mixing tank or sump required; and ventilation isolates each line section from the next, enabling transient flows of at least 35% change in rate to be handled without caviation.

31584 **Evaluation of the cross-section and slope of the channel for transporting the original coal slurry from hydraulic mine activities.** Tien-Yiu, W.; Chu-Lung, M. pp 237-241 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In order to enable flume cross-section and gradient to be more suitable for the characteristics of the raw coal slurry from hydraulic mining, we've selected Yiang Chuang Colliery as the test site and carried out this expermental research work. The flume originally used was of 350 mm in bottom width, 300 mm in height, with a gradient in side wall of 76° and an installing gradient of 7%. Through field observation and analysis, we recognized that strata pressure may damage the flume cross-section and the features of the slurry may change greatly. Therefore, the flume height was reduced to 200 mm and the bottom width of the flume was increased up to 450 mm, considering the requirements of strata pressure and the slurry passing through. At the same time, after summarizing the developing trend of the slope in every colliery, the flume gradient was changed to be 10%. The new flume is of lower in side wall height, larger in bottom width and shorter in single section length. Since it was put into operation, about 3 million tons of coal have already passed through. Flume blockage and slurry overflowing have been basically eliminated. Now it has been proposed to use the new flume in concerned collieries.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 31557, 31568, 31572, 31576, 32340

31585 **(BNL—29773) Coal-oil mixtures: an alternative fuel for the commercial markets and large residential markets.** Butcher, T.A.; Isler, R.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 29p. (CONF-810674—2). NTIS, PC A03/MF A01. Order Number DE81028335.

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Results are presented of Phase I of a program aimed at promoting wide-spread use of coal-oil mixtures in large residential and commercial sector size oil-fired heating equipment. Fuel properties are discussed including viscosity, heating values, and effect of coal particle size. On-site mixing of COM is not considered practical for users in this size range and a number of central preparation plant projects are in progress. Options for on-site storage including the addition of paddle agitators, recirculation agitation systems, auxiliary tanks, and stable slurries are discussed. Fuel pump, controls, and atomizer modifications will be required as well. The coal as may present special problems and sootblowers, cyclones, baghouses, and scrubbers are considered.

31586 **(DOE/TIC—1028580) Transport characteristics of alternate slurry fuels. Quarterly technical progress report, April-June 1981.** (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Energy Technology Center). 1981. 5p. NTIS, PC A02/MF A01. Order Number DE81028580.

The objective of this project is to develop flow data for various alternate fuels, such as coal/water mixtures, in a pump loop which accurately simulates fuel feed systems found in boiler and furnace applications. The program is primarily concerned with measurement and correlation of pressure loss as a function of slurry characteristics and system design. The flow studies are being supported by laboratory studies. During this quarter, work on the project was initiated. An existing loop was redesigned by lengthening both the vertical and horizontal straight sections and by simplifying the tank discharge/pump suction inlet section to eliminate unnecessary bends or elbows. Locations were selected for the pressure measurements, temperature measurements, flow measurements, and grab sample ports. A data acquisition system was defined.

31587 **Fifth international technical conference on slurry transportation. Proceedings.** Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980). 301p. (CONF-800371—).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The fifth international technical conference on slurry transportation was held March 26-28, 1980, at the Sahara Tahoe, Lake Tahoe, Nevada. The papers deal with the transport of slurries (mostly coal and iron ores) in slurry pipelines. Planned slurry pipelines in the USA are described and the legal problems in getting rights-of-way and water rights. The economics of slurry pipelines and railways are considered in some detail. Finally, technical aspects of such pipelines are considered: design, engineering, pumps, maintenance, etc. Other topics discussed are: marine transport (moorings, terminal facilities and tanker ship design, other slurry media than water (fuel oils, methanol, CO_2), coarse slurry transport, slurry preparation, water removal and pumps (pulsations and dampering). Thirty-two papers have been entered individually into EDB and ERA; one had been entered previously from other sources. (LTN)

31588 **Status of the ETSI coal slurry pipeline.** Wasp, E.J. pp 2-4 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The physical availability of the water for an ETSI pipeline is not an issue. The problem is a political one. That is why we are working very closely with the state of South Dakota to try to solve the political issue by providing water in a combined pipeline to the western part of the state, which is a water-scarce area. Figure 4 presents a history of the industry's efforts to obtain federal eminent domain for coal slurry pipelines, starting in 1962 with the Kennedy administration and proceeding to the present date without tangible results. The history of the state eminent domain effort has been somewhat more successful. Eminent domain laws were passed in Oklahoma, Texas and Louisiana. In Arkansas and Wyoming, the existing laws are broad enough to permit eminent domain for slurry pipelines. The state we've been unsuccessful in is Nebraska, and that is due of course, to a very strong railroad opposition. Railroads have the power to block coal slurry pipelines, particularly in the east and midwest because the railroads own their right of way in fee and can simply deny pipelines approval to cross under their tracks. However, in the west ETSI has found a solution to this monopolistic impediment to access to the marketplace by its window program. We actually went up and down the 1400 miles of pipelines and found places where the railroads did not own the land in fee. We successfully negotiated agreements with the fee owners for subterranean easements and then filed in the courts to have our titles verified. We had to file 65 lawsuits, and I'm pleased to say that all were won, including a few that were appealed. Although the ETSI project will only cross about 32 miles of federal lands in Wyoming, this was enough to trigger the NEPA process. In May 1979 the formal EIS process was started.

31589 **Continental Resources Company.** Silver, R.P. pp 10-11 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In summary, a lot of progress has been made in the last year, not so much in the technical side of the project but in what is called the commercial, the political side. We have firmed up what is believed to be a very strong relationship with the utilities and they are participating as partners in terms of studies on technical questions at the power plant site, procurement questions and coal fields, and most importantly they have been asked to join in the work this year to put together what is described as a pro forma contract that would be required between the pipeline and the user sufficient to secure financing for the project. It is believed that once we have gotten over the eminent domain question, that a very important and difficult question is the financing and we are working on that right now in a cooperative mode with the utilities. However in the final analysis it is going to be their credit that is primarily responsible for the financing of the pipeline and for their benefit.

31590 **Pacific bulk transportation system.** Kopeikin, L.I. pp 12-15 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Our purposed project demands not only a coal slurry pipeline, but also ships and ship loading facilities. The idea is to export coal by bringing it to the coastline by pipeline and transporting it to the Far East in large bulk carriers. The pipeline is proposed to go to Southern California. The coal then goes by ship to Japan, Korea, Taiwan. We begin at the mine mouth with slurry preparation facilities at each mine location. In our study of coal collection alternatives, we found that short slurry pipelines were the most economical method of bringing coal to the head-end of the pipeline. The head-end pump station pressurizes the slurry to about 1200 psi. Pump stations are located along the way to overcome friction losses and mountainous obstructions. At the pipeline terminus are large dump ponds into which the slurry is discharged. After a period of settling, dewatering would take place from the ponds. We have a water treatment plant at the terminal location to convert the water from the system into potable water which can then be sold in the local area. When a ship comes in for loading, it ties up at a single point mooring buoy in deep water offshore. The slurry is pumped out to the ships and dewatered. The ships will be loaded with about 75% coal and 25% water at departure. These ships are on the order of 350,000 dead-weight tons possible because they can load in deep water.

31591 **Operating experience of the Black Mesa Pipeline.** Montfort, J.G. pp 16-23 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Black Mesa Pipeline began commercial operation in November, 1970 and has transported 30,000,000 tons (27,000,000 metric tons) of coal with a high degree of reliability. This second generation coal pipeline has been an economic and technical success and experience gained on this system will be helpful to the next generation of coal pipeliners. The Black Mesa system consists of 273 miles (439 km) of mostly 18" (457 mm) pipeline, a slurry preparation plant and four reciprocating pumping stations which operate tightline without surge tankage. This pipeline connects the Mohave Generating Station in southern Nevada to its coal supply, a Peabody Coal Company near Kayenta, Arizona. The mainline traverses generally rough terrain some of which is mountainous. No mainline valves are in the first three sections; two remotely controlled valve stations are situated in the last section, which drops 5000 feet (1524 m), to permit sequential closing and a stepped down pressure gradient in case of shutdown on slurry. Pipeline slopes are limited to 16% in order to limit solids build-up in sags which occurs during shutdowns on slurry; this has to do with restartability. An internal corrosion allowance of 2 mils (50 um) per year was provided. Pump stations have numerous motor operated valves because of sequencing having to do in part with flushing slurry out of a pumping unit following shutdown and filling with slurry prior to starting. These and other features are handled by local logic, but stations can be started, stopped and regulated from a System Control Room located at the origin facilities.

31592 **Kudremukh iron ore concentrate slurry pipeline.** Wilk, A.S.; Green, W.H.; Pitts, J.D.; Vajda, J.; Wilson, C.; Hay, E. pp 24-33 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

This paper briefly describes the system for transporting 7.5 million tons of iron concentrate in a 67-kilometer buried slurry pipeline, including a 2-kilometer tunnel, through inaccessible mountains and difficult terrain in southern India. The system, rated at a maximum design throughput of nearly 1700 dry tons per hour, will

be one of the largest capacity long-distance slurry pipelines in the world. In addition, the system is the longest pipeline constructed to date in which motive force is provided by centrifugal pumps. The initial study, design, and procurement phases of the pipeline are discussed with emphasis on key implementation decisions during each phase and problem areas.

31593 **Coal slurry lines: projects for the future supply of energy for Austria.** Schedelberger J. (Technische Univ. Vienna, Austria). pp 34-39 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Autstia's energy supplies and energy demand are considered to about 1990. The feasibility of several slurry pipelines in this general area are discussed: Poland to Austria; Poland to Italy; Trieste to Austria; and the Rhine-Main-Danube Canal. At present, Austria imports abut 1 million tons of hard coal from Poland. The amount partly consists of lump coal for domestic heating purposes and sorted coal for individual industrial consumers, which is not suited for pipeline transport. By 1984/85 an additional 1.2 to 1.5 million tons of imported hard coal will be required for the thermal power plants now beginning planned or under construction. For this purpose, a long-term delivery contract was already concluded with Poland in 1979. As pipeline transport did not appear to be economically justifiable for such small amounts and an increase of Austrian coal consumption was not foreseen, a preliminary contract was concluded with the Austrian Federal Railways. In fact, the Federal Railways have further reduced their transport rates in order to remain competitive in case a pipeline were to be built. Thus, it will depend on the energy policy of the Federal Government as well as the policies of the oil-producing countries, if and when the project of a coal slurry line from Poland to Austria is to be realized.

31594 **Place of coal slurry pipelines in the future of coal transportation.** Gaskins, D.W. Jr. pp 40-44 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Coal transportation policy is perhaps the thorniest problem facing the Interstate Commerce Commission today. We face conflicting objectives. On the one hand, we have a national energy policy that calls for increased use of coal in order to decrease our dependence on imported energy sources. We are accused of frustrating this policy by allowing coal rates so high that utilities import Polish and South African coal in perference to our own domestic coal. On the other hand, we have a national rail system that is literally falling apart. Only 13 out of the country's 36 Class I railroads were earning enough revenue to maintain current operations on a long term basis, and among these, only three relatively small Class I railroads earn enough to provide an adequate return on investment capital to their shareholders and attract new capital. The dilemma is one that utilities, carriers, coal shippers, the federal government and the general public must face together. Reasonable transportation rates are necessary if coal is to make its proper contribution to national energy policy. But neither coal nor any other traffic can be expected to move indefinitely over railroads deprived of the revenue they need to survive financially. An additional complication facing coal transportation planners is the fact that railroads are not always the only means of transporting coal. Depending on the geographic and marketing factors involved, barge, truck, minemouth generation, and slurry pipelines may be economically feasible alternatives. All of these transportation modes are interdependent. In particular, plans for constructing and operating of coal slurry pipelines are clearly affected by the rail rate policies of the Interstate Commerce Commission, and quite frankly there is considerable uncertainty abut ICC coal rate policy.

31595 **Coal slurry terminal for Rotterdam.** Hoogendoorn, I.D. (SHV Nederland, Netherlands). pp 46-52 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The requirements for a short distance terminal slurry system are totally different from those for the long distance slurry systems. The main influence in the cost optimalization are the transport costs related to the travel distance. To keep coarse coal suspended in slurry doubled flow velocities are necessary in relation to the fine pipeline coal resulting in redoubled energy consumption. Due to the short distances calculations for the Rotterdam terminal end at 0.5 kwh per ton of dry coal handled. This is still half of the energy consumption necessary to handle the coal in the conventional way with grabcranes, stacker/reclaimers and conveyor belts. The dewatering costs for coarse coal slurries are situated in the lower cost ranges because grain sizes above 0.5 mm can be easily dewatered just by screening. In comparison with the long distance slurry systems, it is unnecessary to say that the terminal has no costs for grinding the coal as most coal-contracts of our clients circumscribe the coal sizes as 50 to 0 mm with not more than 35% below 2 mm to prevent dust pollution at the conventional open handling facilities of our clients. From the feasibility studies made for the conventional terminal and the one made for the slurr terminal we can have now a good picture of the economics of both systems. Table 2 gives the estimated investments, which shows that a slurry terminal may be built about 30% cheaper than a conventional terminal. In Table 3 the cost structure is given as a percentage of the final costs per throughput ton in the conventional terminal. The final costs per throughput ton are more than 25% less as in the conventional system. A better incentive to proceed in studying slurry handling at a terminal is hardly to be found.

31596 **Economics and design of slurry tankers.** Ghusn, A.E. pp 53-61 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

A tanker built for carrying oil is not suitable for carrying slurry. Extensive modifications must be made to the oil tanker or designed into the slurry tanker for the following reasons: (1) A slurry tanker must have a slurry loading system. This system could be integrated with the oil loading system in a new building. (2) A decant system must be installed to remove the supernatant as the solids settle. The system must be designed to accommodate different heights of solids in the hold which result from repeated loadings to achieve tonnage. The proper sequencing of loading and decanting is essential to minimize port time. (3) A slurry discharge system must be different from the oil systems since: (a) Oil pumps are not suitable to handle slurry. (b) Oil pumprooms are located aft of the cargo holds, for safety reasons, which could add considerably to pumping costs. (c) Reslurrying equipment must be maintained and, therefore, a void must exist under the cargo holds. (4) Any holds designated for slurry cargo must not have protruding structure that complicates hold cleaning. (5) Design calculations and stress measurements on existing slurry ships have shown the need for additional hull strength. Figure 6 shows the approximate added steel requirements of a slurry tanker versus a straight tanker. Stability requirements in slurry mode may dictate changes from conventional hold arrangements.

31597 **Floating offshore terminals for slurry transport.** Pollack, J. pp 62-73 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The SPM teminal with a ship to shore pipeline represents an attractive low cost alternative to development of a deep water port with conventional loading/unloading systems. It can be built in a shipyard and installed at remote locations for predictable costs. Relocation of the terminal is possible if the operation has a limited life. The low cost of mineral ocean transport combined with low loading costs made possible by the SPM terminal represent a good, and sometimes the only, viable economic solution for remote area loading of bulk carriers. Particularly in areas with prevalent rough water conditions SPM terminals, due to their seaworthiness, can continue loading operations, whereas exposed pier operations or

even piers with very expensive breakwaters around them, would have to cease loading operations and wait on weather. The slurry terminal offers similar benefits to the processor. For discharge or loading of bulk carriers, SPMs established offshore eliminate expensive wharf facilities with the attendant harbor dredging always necessary to accommodate these large carriers. In addition, conventional bulk loading and discharging facilities create considerable air and water pollution in the form of dust being blown from the material being handled. There is also the constant loss of product due to spillage, and more often than not there is excessive stevedoring damage to equipment. Aside from the environmental impact, these conditions all result in economic losses. A closed-loop slurry discharge system eliminates all the air.

31598 **New concepts in slurry storage.** Pharamond, J.C.; Olderstein, A.J. pp 74-83 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Not only coal, but also iron ore, and several other bulk materials can and will be tranported in liquid form. It is estimated that in 1978 some 50 million tons in all were moved through slurry pipelines. Existing plans will soon raise world annual capacity to 300 million tons. Most installations will be much larger than existing ones and as the system size increases the necessary storage capacity will also increase. We have investigated briefly here some of the fundamental parameters which affect the size of the mixing equipment in large slurry storage tanks. From a performance standpoint it is probably not necessary to maintain complete suspension in the entire storage system. By designing to operate at a reduced or completely settled state, the operating costs can be substantially reduced. The magnitude of possible savings are dependent upon the limits of acceptable operating conditions. In addition, the use of multiple small units may also prove to offer savings in initial investment. Mixers in a common commercial range become less expensive and replacement parts will be stock or have a short lead time. Using an example, this paper has demonstrated that bigger is not always better and that a detailed study of requirements might lead to significant savings. Various alternatives are available and should be evaluated in the early stages of the project development. Specific slurry characteristics and behavior, knowledge of the mixing parameters, and precise process requirements condition the design of agitated slurry storage tanks. The most economical storage system will be achieved only if it is designed as a whole taking all parameters into considerations.

31599 **Non-water slurry pipelines: potential techniques.** Santhanam, C.J.; Dale, S.E.; Nadkarni, R.M. pp 93-105 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

While water slurry pipelines continue to be the dominant method in slurry transport, several new approaches using liquids other than water are under investigation for a variety of purposes. This paper presents an overview of some of these areas under study today. The two major areas of technology which offer unusual possibilities for growth in slurry transport technology are: (1) The transportation of coal using liquid CO_2 as the slurrying medium. This method has been under study at Arthur D. Little and appears promising. (2) The transportation of coal/crude oil slurries and the integration of this feed material to modified conversion facilities capable of accepting such a mixed feed. This paper presents some issues that lead to the consideration of non-water slurry transport technologies and offers some projections and potential possibilities.

31600 **Coal/methanol slurry pipelines.** Aude, T.C.; Chapman, J.P. pp 106-114 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

This paper reviews the state of the art of coal/methanol slurry pipeline design. The results of preliminary laboratory investigation of coal/methanol slurry are presented. The characteristics of coal/methanol slurry are compared and contrasted with those of coal/water slurry, and their probable impact on slurry pipeline design and operation reviewed. Further, the work necessary to commercialize coal/methanol slurry applications is discussed.

31601 **Slurry pipeline activities in West Germany and North West Europe.** Goedde, E. pp 127-135 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Pipeline transport of fine-grained solids has become well known as a feasible means of transportation all over the world. The transport of coarse grained solids is also being used to a greater extent. Transport of coarser particles causes greater pressure losses. However, it means less draining costs, and, for coal, better handling in a coal washing plant. Coarser coal for instance is used in certain gasification processes, and with a view to draining of the ship if imported coal is delivered by pipeline to the loading port. The author himself and Krupp have carried out extensive research and development work on pipeline transport of coal, iron ore, quartz sand, and other solids. For coarse coal transport, Krupp has built a large-scale test unit at Bergbauforschung GmbH (Mining Research Company) in Essen, Germany, which is described in the paper, with an outline of the test program. In particular, the paper explains the activities and the situation in West Germany and North West Europe with respect to slurry piplines. Various recent proposals for pipeline networks or pipeline routes in this region are presented and discussed.

31602 **US Department of Energy hydraulic transport research facility for coarse coal.** Miscoe, A.J.; Faddick, R.R. pp 136-143 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The decision was made in 1975 to build a new, large facility which would permit extensive investigation of the problems of large particle transport. The basic principle of the facility design is that the coal and water are separately metered to the centrifugal pumps through a small mixing tank, passed through the pipeline and separated at the discharge, thus approximating a once-through system. For each cycle the qualities and quantities of the coal and water can be determined. The water can be reused or cleaned after each use, which controls the buildup of fines from attrition during transport. Extensive instrumentation is provided to allow high-speed measurement and recording of transient phenomenona. Provisions are made for environmental concerns, for maxmization of data accumulation and for dealing with operating problems. Among the parameters wihich will be studied for horizontal, vertical, and 45-degree downward flow are: pipe diameter, power requirement, concentration, particle size, fines content of the black water proportion of rock in the raw coal degradation of solids, wear of equipment, transient flow phenomenona, slip velocity, centrifugal pump performance, and transport water quality.

31603 **Potential energy and economic impacts of coal slurry pipelines.** Klein, D.E.; Black, R.F. pp 152-162 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Recent trends in fuel prices and transportation costs have sparked a renewed interest in the possible use of coal slurry pipelines as a mode for long-distance coal transport. Under certain conditions, slurry pipelines are believed to offer transportation cost savings over conventional modes of transport, and may serve to stimulate competition among carriers. In this paper, a range of pipeline and until train cost estimates are compared for a number of key transportation links. This paper builds upon previous studies of coal slurry pipelines and analyzes their potential impact on the coal mar-

kets within the context of a national model for coal supply and demand. The paper also examines the potential impact of coal slurry pipelines on the railroad industry. The main conclusion of the paper is that the greatest savings from coal slurry pipelines may be the indirect savings resulting from increased competition instead of the direct savings stemming from any particular route. Other conclusions of the analysis are: Slurry pipelines are economic over some, not all, routes; while slurry pipelines may appear to have a cost advantage over some routes, insufficient volume demand could negate or postpone the viability of the pipeline; slurry pipelines are forecast to transport between five and nine percent of the total coal transport in 1990, ranging from about 70 to 126 million tons of coal; and non-slurry modes of transport, particularly railroads, will continue to grow regardless of slurry pipelines. Net national savings tend to exist with a network of slurry pipelines, but this is not always true.

31604 **Economical survey on long distance transport of coal and coal derived energy to utilization areas.** Ercolani, D.; Ferrini, F. pp 163-171 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Four coal-derived energy production and long distance transport alternatives were compared on a realistic basis. The results of the survey show that coal transport by pipeline and direct electric power production at the utilization area is the most convenient both from the economical and environmental point of view. The UHV transmission of the electric power produced at the mine site results to be rather disadvantageous as it is charged with higher investment and transport costs and by environmental problems. At present coal gasification and liquefaction do not represent viable alternatives due to the high cost of the synfuel and of the high-Btu gas. Furthermore the synthetic fuels could substitute oil or natural gas only if coal is available at mine site at very low prices or if remarkable increases in natural hydrocarbon prices are expected.

31605 **Coal freight rate spiral.** von Rosenberg, A. (City Public Service, San Antonio, TX); Borchelt, M.; Hewlett, R.A. pp 172-180 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Rapidly escalating railroad coal transortation rates have destroyed the ecpnomic incentive for accelerated coal conversion of many electric utilities presently utilizing gas or oil as their principle fuel supply. The City Public Service of San Antonio will not willingly build another western coal fired generating plant without the assurance of reasonable cost based freight rates or new tranportation alternatives. From May, 1973, the freight rate for coal from the Powder River Basin to San Antonio, TX has changed from $7.90/ton to more than $20/ton. It has actually been cheaper to import coal from Africa and truck it 88 miles to the plant from the port.

31606 **Provisions for use of a coal slurry at the Seminole Plant.** Crumlish, T.E.; Opalinski, M.P.; Peterson, J.D. pp 181-190 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Slurry pipeline transportation of coal to the Seminole Plant appears to be an attractive alternative, but much more work remains before its promise can be realized. Pipeline economics require that a number of users participate in the project. Unfortunately the Seminole project, and perhaps othes, cannot wait until the slurry line coal begins to flow. It is necessary, then, to develop an independent coal receiving system that can be adapted later to receive the slurry line coal. This paper has addressed the prospects of introducing slurry line coal into a power plant designed for all delivered coal. Of great concern to the slurry line coal user will be the drying plant capability and availability as well as finding an environmentally suitable use and disposal of the transport water. Coal slurry centrifuges require a lot of maintenance and a significant amount of coal, perhaps 6% is lost in the centrate. By adding equipment to recover the coal lost with the centrate there will be an increase in maintenance and operating costs for the drying plant. Higher maintenance requirements might lead to reduce equipment availability. Finally, additional investigations and development work should be pursued by the parties to find environmentally suitable metods for the use and disposal of slurry transport water. These investigations should include discussions with representatives of the regulatory agencies and lab analysis of source water and transport water trace elements for various coals.

31607 **Coal preparation and utilization tests for the ETSI pipeline system.** Dermmelaere, R.H.; Wasp, E.J. pp 205-214 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Although crushing and dewatering of coal are based on vast experience, as evidenced in coal cleaning plants, these processes are not entirely compatible with the specifications and more stringent requirements for long-distance coal slurry transportation. Hence, the slurry pipeline process engineer now finds that his responsibilities encompass preparation and dewatering, as well as coal slurry transportation. These processes, which do not benefit from a long history when specifically applied to coal slurry pipelines, require further development and adaption to the specific coals being utilized. This paper describes ETSI's work, carried out over the past several years, on coal preparation and dewatering. ETSI has drawn on the experience gained at Eastlake and Mohave and introduced the necessary measures to circumvent the troublesome features of these processes. Only commercially proven equipment will be used in the ETSI system. Innovation in the dewatering plant process and the substantial impact of coal characteristics on the optimal selection of coal preparation and dewatering and dewatering equipment dictated the need for the Vendor Test Program to demonstrating the viability of ETSI's process. The basic process viability has been confirmed. THe Vendor Test Program is the precursor to the 50 ton per hour Coal Evaluation Plant. The Coal Evaluation Plant, to commence operation in the latter part of next year, will permit fine-tuning of the processes with respect to coal characteristics and leave virtually no design criteria unconfirmed when detailed engineering commences.

31608 **Pipeline terminus fine coal recovery and water clarification using a static thickener.** Ackerman, J.R>. pp 215-221 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In a review of the HYDRA Hydraulic Rake static thickening system for use in the emergency dump tank at a coal slurry pipeline dewatering facility of at one of the intermediate pump stations and or use in the centrifuge effluent clarifer, we would like to again point out the advantages the Hydraulic Rake possesses. By using the Hydraulic Rake the slurry can be allowed to settle to the floor of the tank and even compact thereby eliminating the need to keep the slurry in suspension. Then, before withdrawal of the slurry the Hydraulic Rake would draw clean water from above the settled coal and expel it back through the segment orifices to reslurry the compacted coal to a pumpable concentration. This process is feasible only for short term storage of the coal slurry. The matching of an efficiently designed settling basin that alows compaction of the settled solids and the Hydraulic Rake that is capable of removing the compacted solids provides a more efficient system for removal of coal fines that are not recovered during the preliminary dewatering of the slurry. The clarification of the carrier water occurring during the sludge removal process is also important, whether the water is to be discharged or ultimately reused. One additional thought that should be considered for any application involving the sedimentation and removal of solids is to take advantage of the natural occurring static thickening process, which occurs for both individual particles and flocculated solids, to attain the highest possible sludge concentration before withdrawal of the sludge.

31609 **Quality characteristics of slurry wastewater resulting from the slurry pipelining of eastern coal.** Moore, J.W. pp 242-250 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Water quality will almost certainly be a significant factor in the slurry lining of eastern coal whereas the acquisition of sufficient water rights was and is the more important consideration in the slurry pipelining of western coal. For long distance movement of large volumes of coal, water quality will probably not be a controlling economic consideration in the development of a pipeline project. However, water quality considerations are sufficiently important that they need to be integrated in all appropriate phases of the development of a project.

31610 **Influence of non-Newtonian rheology in mixed homogeneous-heterogeneous slurry flow.** Hanks, R.W. pp 251-260 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Slurry pipeline design is a complex process in which many factors must be considered. Slurry velocity, solids concentration, particle size distributions, transport vehicle properties, hydraulic grades, and rheology, are among the factors which influence the design of the pipeline. Of special importance in the specification of a slurry pipeline are the critical velocity and hydraulic resistance characteristics because these factors govern pipe size and pump requirements. In most slurries of commercial interest economic considerations dictate the use of high concentrations and particle size distributions weighted significantly towards the fines end to provide a slurry with good pumping characteristics and high solids transport rate. The use of such loadings frequently gives rise to non-Newtonian fluid properties for the vehicle portion of the slurry. As a result, conventional hydraulic design methods based on Newtonian fluid concepts may fail or produce misleading results and scale-up to large diameter pipes may become a difficult process. In this paper the effects of non-Newtonian slurry rheology on the critical velocity and on transitional and turbulent hydraulic resistance (friction factors) are discussed for the commercially interesting case of mixed slurries in which a combination of homogeneous and heterogeneous flow behavior is expected to occur. Some problems associated with neglect of these effects or of improperly accounting for them are pointed out. Methods for solving these problems are suggested and illustrated in terms of an example pipeline design case.

31611 **Slurry pumps in intermediate pressure applications: an assessment.** Sellgren, A. (Chalmers Univ. of Technology, Sweden). pp 262-266 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In short-distance in-plant slurry transportation systems, the pressure required normally is below 0.5 MPa. In these applications centrifugal pumps usually are the only economical alternative. In high-pressure long-distance slurry pipeline transportation systems positive displacement pumps, operating at pressure of 8 to 16 MPa, are used. Pumping with positive displacement pumps limits the maximum particle size to about 2 mm, due to narrow valve passages but no such limitations exist with centrifugal pumps. Recently pumping with working pressures of up to 5 MPa with centrifugal pumps has been reported and therefore, an interesting intermediate area exists, in which both types of pumps are technically feasible. Feeders etc. are believed to be very competitive alternatives to conventional slurry pumps. However, feeding systems are not considered in this study. In hydraulic hoisting applications the working pressures generally are moderate to high. As the flow rate normally is below, say, 0.1 m^3/s, positive displacement pumps are an economically interesting alternative. With certrifugal pumps the vertical length of transportation will, however, be limited because of the large number of pumps required. In the present study, a technical and economic comparison has been made of hydraulic hoisting in systems based on series installation of centrifugal pumps and positive displacement pumps, respectively.

31612 **Evaluation of slurry pumps.** Gandhi, R.L.; Snoek, P.E.; Carney, J.C. pp 267-275 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

In most cases, selecting a pump for a specific slurry pipeline system is a compromise between the designer's preference and the equipment that is available. An important consideration is that pumping equipment is available in discrete unit sizes, according to inlet and outlet pipe size, maximum pressure capability, flow capability, and horsepower rating. Other considerations include initial capital investment, operating cost, and the degree of skill required to operate and maintain the equipment. For example, although centrifugal pumps have lower capital costs than piston or plunger pumps, they have higher power costs because of their lower mechanical-hydraulic efficiencies. In cases where only a single pump station is needed, the heat requirement and maximum particle size that the system must handle may be sufficient to decide the kind of pump to be used. Figure 1 shows the general areas in which major pump types are suitable. As the figure shows, there are conditions for which only one type of pump is applicable, and there are gray areas where more than one pump type can be used. In long cross-country pipelines, the number of pump stations and the required lift per station is prescribed by the designer. Generally this is decided from the results of a comprehensive economic analysis in which the cost of pipe steel is balanced against the capital and operating cost of the pump stations for various pipe diameters, solids concentrations, pipeline routes, etc. Although there has been a tendency in the past to select systems with relatively few pump stations having high discharge pressures, each case must be carefully considered. It is quite possible that project conditions could warrent a pipeline system having many stations with low to moderate heads.

31613 **SAMARCO pumping system.** Jennings, M.E. pp 276-286 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

The development of pumping hardware for long distance slurry pipelines has achieved a new level of accomplishments with the SAMARCO system. The SAMARCO hematite ore while being quite fluid, is abrasive. The special feature of a continuous flush plunger has allowed this slurry to be pumped at high pressure at acceptable maintenance levels. SAMARCO's special requirement of operation in batch mode imposes a number of significant constraints on the pumping system that all point to the desirability of the positive displacement type pump.

31614 **Pulsation control for slurry pumps.** Miller, J.E.; Miller, J.D. pp 287-295 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

All reciprocating positive-displacement pumps possess certain characteristic flow variations in the discharge (outlet) and suction (inlet) caused by the geometry of the typical power-ends driving the displacement elements (pistons or plunges). The typical flow variations of multi-cyclinder pumps of different types are also shown. Because pressure is a function of the second power of velocity (flow rate), the instantaneous pressure variations produced by the flow variations can be two times greater as a percentage of average discharge pressure. These pressure variations (pulsations) can be damaging to the pump and system in that all parts are subjected to high cyclic stress ranges resulting in fatigue, and the pulses can set up severe pipe vibrations by reaction in certain sections of the system if that section has a natural pulse frequency. Unfortunately, the pump-generated frequencies lie very close to typical pipe-span natural frequencies. In multiple pump installations where the discharge and suction is directed into common headers,

it is even more important to use pulsation control on both the discharge and suction to prevent the excessive pressure pulses that result when the pyumps are in phase. The application of gas-filled bladder type-dampeners is finding increasing acceptance in most applications because of their efficiency and ability to control pulsations over a rather wide range of pressure and pump speeds. For reciprocating pumps in slurry pipeline service, the use of two or more discharge dampeners (with a total gas volume as required for one dampener) should be considered for the reasons given.

0140 Combustion

REFER ALSO TO CITATION(S) 31564, 31587, 31796, 31940, 32327, 32354

31615 **(DOE/PC/40270—1) Combustion enhancement and pollutant control research with acoustically induced mixing. Technical progress report, March-June, 1981.** Faeser, R.J.; Rudnicki, M.I. (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Jul 1981. Contract AC22-81PC40270. 22p. NTIS, PC A02/MF A01. Order Number DE81027016.

An experimental research program has been initiated to evaluate the possibility that beneficial effects can result when acoustic energy is impressed on the combustion zone of pulverized coal furnaces. These benefits include the reduction in NO/sub x/ generation, the increase in combustion intensity, and the increase in turndown ratio (maximum flow/minimum flow). The postulated reason for these possible benefits is the fine stirring action of high frequency acoustic waves. The first three-month period of this program was devoted to the formulation of a test plan, the design of the 5 lb/hr coal rate combustor with acoustic driver attachments, and the specification of the test facility.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 31543, 31546, 31589, 31590, 31926, 31941, 32153

31616 **Engineer's look at coal.** pp 43-46 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The economics and regulatory factors involved in increasing the production of bituminous coal in Pennsylvania are discussed in this article. Governmental regulations and additional taxes are adding from $4.00 to 17.00 per ton to the cost of coal being produced now. The development of new coal mines are also discussed. The author estimates that it may take more than 9 years to attain full production from mines being planned at the present time. (DMC)

0160 Health And Safety

REFER ALSO TO CITATION(S) 31548, 31569, 32584, 32594

31617 (ORNL—5806, pp 54-58) **Life Sciences Synthetic Fuels Program.** Jul 1981. NTIS, PC A04/MF A01.

In Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.

The Life Sciences Synthetic Fuels Program (LSSFP) has the objectives of supporting development of environmentally acceptable fossil fuel technologies, developing health and environmental information on principal issues, and conducting and validating health and environmental assessments. Key environmental and health concerns in coal conversion relate to: worker and public health and safety, solid waste management, air and water quality, and ecological and socioeconomic impacts. The program emphasizes those processes for converting coal to synthetic fuels; however, the program also contains research in health and environmental aspects of coal combustion and oil shale.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 31534, 31588, 31616

31618 **(ORNL/EIS—171) Environmental compliance program handbook.** (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 332p. NTIS, PC A15/MF A01. Order Number DE81030226.

As a part of our country's effort to achieve energy independence, the Department of Energy (DOE), Fossil Energy, has conducted a research and development program to provide technology that will permit rapid commercialization of the processes for converting coal, and other solid fossil fuels, into products to substitute for those derived from natural gas and oil. As an integral part of this effort, the DOE has taken the position that all projects involving fossil fuels be in compliance with aplicable state and federal governmental laws and regulations. Only by demonstrating that these new technologies can be built and operated without adverse environmental impact can these technologies be considered as proven and ready for commercialization by the private sector. This handbook is one of a series covering federal laws and regulations and the laws and regulations of selected states that pertain to air quality, water quality, and the identification and disposal of solid and hazardous wastes. The data summary sheets are part of a computer file built for DOE by Oak Ridge National Laboratory. This handbook identifies and provides abstracts to those pertinent laws and regulations which were in force in the State of Ohio in early 1980. The permit forms are those in use during that time frame. Concerns about possible changes and additions to applicable laws and regulations occurring since 1980 should be directed to the Ohio Department of Environmental Protection.

02 PETROLEUM

0201 Reserves

31619 **(ANL/ES—116) Petroleum geology and resource assessment of the middle Caspian Basin, USSR, with special emphasis on the Uzen field.** Ulmishek, G.; Harrison, W. (Argonne National Lab., IL (USA)). May 1981. Contract W-31-109-ENG-38. 157p. NTIS, PC A08/MF A01. Order Number DE81029951.

The Middle Caspian Basin contains up to 12,000 m (40,000 ft) of sedimentary rocks ranging in age from late Paleozoic to Quaternary and has over 100 oil and gas fields varying in size from small to supergiant. The Soviet literature reviewed for this report covers: (1) tectonic zones of the basin, including details of the lower, intermediate, and upper structural complexes; (2) paleogeography, facies distribution, and conditions of organic matter accumulation in the major petroleum source rocks; (3) stages of oil and gas generation; (4) major hydrogeological features; and (5) producing regions of the basin. Total initial petroleum resources of the basin are estimated at 22.5 x 10^9 t (166 x 10^9 bbl), of which 16.0 x 10^9 t (118 x 10^9 bbl) are yet to be discovered. Resources of the offshore Caspian Sea area are estimated to be 12.1 x 10^9 t (89.5 x 10^8 bbl). The most promising zones for offshore exploration are the plunging continuation of the Central Mangyshlak system of uplifts and the South Dagestan area. Initial reserves (oil in place) of the supergiant Uzen field are calculated to be 1.02 x 10^9 t (7.50 x 10^9 bbl). Because the recovery efficiency is estimated at 26 to 39%, recoverable oil is 0.261 to 0.397 x 10^9 t (1.98 to 2.96 x 10^9 bbl). Analysis of the exploitation of the field shows significant difficulties related mostly to marked nonuniformity of reservoir permeability and to the high paraffin content of the oil.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 31629, 32453

0203 Drilling And Production

REFER ALSO TO CITATION(S) 31633, 31638, 31649, 32337, 32392, 32601

31620 (DOE/BC/10255—4) Characterization of fluid flow in naturally fractured reservoirs. Final report. Evans, R.D. (University of Central Florida, Orlando (USA). Coll. of Engineering; Oklahoma Univ., Norman (USA). School of Petroleum and Geological Engineering). Aug 1981. Contract AC19-80BC10255. 64p. NTIS, PC A04/MF A01. Order Number DE81029491.

This report summarizes the results of a four month study of the characteristics of multiphase flow in naturally fractured porous media. An assessment and evaluation of the literature was carried out and a comprehensive list of references compiled on the subject. Mathematical models presented in the various references cited were evaluated along with the stated assumptions or those inherent in the equations. Particular attention was focused upon identifying unique approaches which would lead to the formulation of a general mathematical model of multiphase/multi-component flow in fractured porous media. A model is presented which may be used to more accurately predict the movement of multi-phase fluids through such type formations. Equations of motion are derived for a multiphase/multicomponent fluid which is flowing through a double porosity, double permeability medium consisting of isotropic primary rock matrix blocks and an anisotropic fracture matrix system. The fractures are assumed to have a general statistical distribution in space and orientation. A general distribution function, called the fracture matrix function is introduced to represent the statistical nature of the fractures.

31621 (DOE/BETC—81/2) Contracts for field projects and supporting research on enhanced oil recovery and improved drilling technology. Progress review No. 26, quarter ending March 31, 1981. Linville, B. (ed.). (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Jul 1981. 158p. NTIS, PC A08/MF A01. Order Number DE81029998.

Objectives and technical progress are summarized for field projects and supporting research in chemical flooding, CO_2 injection, thermal/heavy oil recovery, resource assessment, extraction technology, microbial enhanced oil recovery, and improved drilling technology. (DLC)

31622 (DOE/BETC/QPR—80/4) Liquid fossil fuel technology. Quarterly technical progress report, October-December 1980. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). May 1981. 77p. NTIS, PC A05/MF A01. Order Number DE81029912.

Highlights of research activities at BETC during the past quarter are summarized in this document. Major research areas include: liquid fossil fuel cycle, extraction (resource assessment and enhanced production); processing (characterization, thermodynamics, and process technology); utilization; and product integration and technology transfer.

31623 (DOE/ET/12044—54) Micellar-polymer joint demonstration project, Wilmington Field, California. Third annual report, June 1978-July 1979. Staub, H.L. (Long Beach City Dept. of Oil Properties, CA (USA)). Aug 1981. Contract AC03-77ET12044. 40p. NTIS, PC A03/MF A01. Order Number DE81029488.

The micellar-polymer demonstration project to be conducted - through the design phase - in the HXa sand of Wilmington Field is proceeding satisfactorily but has fallen behind schedule. Results of some core floods were unsatisfactory. The recovery efficiencies were much lower than those achieved using the laboratory sample cosurfactant final design slug. Nearly six months of reformulating and additional core testing were required to finally achieve satisfactory laboratory results. Other laboratory tests were performed to optimize the polymer buffer for size and concentration. Other reservoir and reservoir fluid problems have been encountered in production and injection operations during the pre-flush period.

31624 (DOE/ET/12056—14) Effectiveness of foam as a blocking agent at elevated temperatures over extended periods of time. Wilson, T.D.; Marsden, S.S. (Stanford Univ., CA (USA). Petroleum Research Inst.). Jul 1981. Contract AC03-76ET12056. 45p. NTIS, PC A03/MF A01. Order Number DE81026706.

The ability of foaming agents to withstand elevated temperatures over extended periods of time has been studied for their potential use in thermal recovery operations. Thirty-four samples were studied in a preliminary screening apparatus in which foaming ability was observed at the boiling point of water over a one week period. The sulfonate samples and some of the cations showed the best results while the nonionics showed the poorest. A second study involved the injection of slugs of water or foamer solution into an unconsolidated sandpack followed by continuous gas injection. Temperatures ranged from room temperature to 360°F. The slug containing foamer solution decreased gas flow rate through the sandpack significantly more than the water slug. In time the gas flow rate would increase again, but injection of more foamer would cause it to decrease to even lower levels than the previous injection.

31625 (DOE/ET/12056—25) Algorithm for computing in-situ combustion oil recovery performance. Fassihi, M.R.; Gobran, B.D.; Ramey, H.J. Jr. (Stanford Univ., CA (USA). Petroleum Research Inst.). Oct 1981. Contract AC03-76ET12056. 29p. NTIS, PC A03/MF A01. Order Number DE81030340.

An algorithm was developed to estimate the in-situ combustion performance in the field. A calculator program was prepared using this algorithm. The program is efficient, simple and accurate. Given estimates of fuel concentration, air/fuel ratio, gas and oil saturations, and injection rate, for each volume burned, oil recovery, air requirement, and time may be calculated.

31626 (DOE/ET/12056—30) Determination of the duration of the infinite-acting period for interference testing in closed rectangles. Gobran, B.D. (Stanford Univ., CA (USA). Petroleum Research Inst.). Oct 1981. Contract AC03-76ET12056. 42p. NTIS, PC A03/MF A01. Order Number DE81030558.

During a pressure drawdown test of one well in a closed rectangle, that well and any observation wells will behave as if they are in an infinite reservoir for a brief period (termed the infinite-acting time). During this time the producing well pressure-time data will follow the storage and skin type curve while the data for the observation well will follow the line source solution. The time when the producing well itself deviates from this infinite-acting case has already been studied. This report gives a computer program as well as contour graphs that yield the dimensionless time in terms of area, t/sub DA/, which defines the end of the infinite-acting period for observation wells with a producing well located in several positions in various closed rectangles. The reciprocity principle can be used to extend the results. 35 figures.

31627 (DOE/ET/13001—T2) Coalinga polymer demonstration project. Third annual report, July 1977-July 1978. (Shell Oil Co., Houston, TX (USA)). Jul 1978. Contract AC03-77ET13001. 78p. NTIS, PC A05/MF A01. Order Number DE81029423.

The Coalinga Polymer Demonstration Project in California is designed to test polymer flooding as an enhanced waterflooding technique and to provide a direct comparison between waterflooding and polymer flooding. The demonstration project has been organized into five phases: evaluation phase, development phase, water injection phase, polymer injection phase, and production monitoring phase. Field testing and the selection of the pilot site were completed during the Evaluation Phase. The drilling of new wells, the reconditioning of wells, and the installation of injection and production facilities were completed during the Development Phase. The Water Injection Phase began in June, 1976, with the injection of 5400 barrels per day into four 18-acre inverted five-spot injection patterns. The total 116-acre project area also includes a 44 acre updip area (with no injection wells) that will be monitored. The Polymer Injection Phase began in May, 1978, and is expected to continue for two to three years. The Production Monitoring

Phase will consist of one year of data gathering and reporting. Additional water injection will follow the polymer slug for eight years.

31628 (EGN—95) Electrical earth-resistivity surveys near brine holding ponds in Illinois. Reed, P.C.; Cartwright, K.; Osby, D. (Illinois Inst. of Natural Resources, Champaign (USA). State Geological Survey Div.). Apr 1981. 33p. Illinois State Geological Survey Div., Champaign. Order Number DE81904001.

Electrical earth resistivity surveys were conducted in the vicinity of five oil field brine holding ponds to develop a methodology for identifying elevated levels of soluble salts near oil fields. The five sites, all in similar hydrogeologic environments, were distributed across the main oil-producing region of Illinois. Four of these sites were selected for detailed study of a possible relationship between changes in apparent electrical earth resistivities and changes in water quality. The resistivity surveys clearly indicate the direction and extent of salt water migration around the holding ponds. Apparent resistivity measurements can be used to approximate quality of the ground water because there is a direct relationship between the resistivity and water quality. This relationship can be used to indicate relative salinities; however, the relationship should be used with caution in making estimates of water salinity. Brine migration has not affected the regional water quality, and appears to be of limited regional significance. Studies of water chemistry from observation wells at the selected holding pond sites indicated that some attenuation of the brine is occurring.

31629 (NP—1904014) Plan for technological research and development related to the petroleum activities on the Norwegian Continental Shelf: 1981-1985. Appendixes. (Royal Norwegian Council for Scientific and Industrial Research, Oslo). 10 May 1980. 171p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE81904014.

The environmental and geographical conditions on the Norwegian Continental Shelf (NCS) which may effect field exploration and development philosophy or the choice of technological solutions are identified. Research requirements are described in the areas of physical environment; petroleum exploration; petroleum technology; production technology; sub-sea production systems; platforms and supporting equipment; storage and offshore loading; pipelines; underwater support functions; above-water support functions; automation in offshore production and transportation; communications and positioning; materials and corrosion protection; quality assurance; and regulations. High priority programs have been defined based on the general objectives of the national petroleum policy, resource management, safety, industrial development, and cost reduction.

31630 (PB—81-105116) Alaska OCS socioeconomic studies program. Technical report No. 56. St. George basin petroleum technology assessment. Final report. Hanley, P.T.; Wade, W.W.; Feldman, M.F. (Dames and Moore, Anchorage, AK (USA)). Aug 1980. Contract DI-AA851-CTO-3. 299p. NTIS, PC A13/MF A01.

This report identifies the petroleum technology that may be used to develop the oil and gas resources of the St. George Basin OCS Lease Sale No. 70. The analysis focuses on both the individual field development components (types of platforms, pipelines, etc.) and the overall development strategies.

0204 Processing

REFER ALSO TO CITATION(S) 32147

0206 Health And Safety

31631 (AD-A—089341) POL storage as a target for air attack: evidence from the World War II allied air campaigns against enemy oil installations. Interim report, May 1944-August 1945. Dews, E. (RAND Corp., Santa Monica, CA (USA)). Jun 1980. Contract MDA903-77-C-0107. 30p. NTIS, PC A03/MF A01.

Prepared as background material in support of a study of possible vulnerabilities in NATO's rear areas, this note provides a brief analytical review of the results of World War II allied air attacks against oil installations in Germany and Japan, with special reference to the damage done to POL storage facilities. It describes the types of attacks, summaries their effects, points out the importance of secondary damage due to POL fires, and raises questions about present-day vulnerabilities to conventional air attacks. The note is based mainly on the detailed reports of the United States Strategic Bombing Survey.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 31926, 32120

31632 (BNL—51314) Situation report for petroleum exporting countries. Hermelee, A.; D'Acierno, J.; Beller, M.; Smith, T.A. (Brookhaven National Lab., Upton, NY (USA)). Nov 1980. Contract AC02-76CH00016. 180p. NTIS, PC A09/MF A01. Order Number DE81030146.

This report incorporates the contents of fifteen individual situation reports for major petroleum exporting countries that were prepared from the Office of Energy Emergency Management Information System. The situation reports give a synopsis of political, economic, and petroleum industry data for each oil exporting country and are designed to provide up-to-date information enabling the EEMIS Project Office to react in a timely manner to late-breaking events. The report gives a brief overview of crude oil production for the major oil producing regions of the world and identifies crude flows from the major oil producing to consuming regions - Western Europe, United States, and Japan.

31633 (DOE/EIA—0185-80) Costs and indexes for domestic oil and gas field equipment and production operations, 1980. Funk, V.T.; Anderson, T.C. (Department of Energy, Washington, DC (USA). Energy Information Administration). Feb 1981. 196p. NTIS, PC A09/MF A01. Order Number DE81029785.

Domestic oil field and gas field production equipment and direct annual operating costs and indexes are presented for 1980. Also, linked index numbers for 1979 and 1980 are shown together with the 1980 costs for each component. Costs and indexes for primary operations in six areas, secondary operations in one area, primary operations in the Gulf Coast offshore area, and gas well operations in six areas are detailed in the 119 appendix tables. Between midyear of 1979 and midyear 1980, the indexes for oilfield equipment costs increased 15.7 percent for primary, and 15.6 percent for secondary recovery production. Direct operating costs for these categories rose 18.7 and 11.9 percent, respectively. Offshore operating costs for the 12-month period showed an 11.1 percent increase. Gas well equipping costs increased 13.5 percent while the operating costs increased 15.0 percent. During this same period the consumer price index rose 14.3 percent.

31634 (DOE/EIA—0297) Venezuela, Trinidad and Tobago: crude oil potential from known deposits. Dietzman, W.D.; Rafidi, N.R.; Warner, A.J. (Department of Energy, Washington, DC (USA). Energy Information Administration). Jul 1981. 127p. NTIS, PC A07/MF A01. Order Number DE81027023.

This report presents an analysis of the future oil supply potential from the known fields of the republics of Venezuela and Trinidad and Tobago. Presented herein are estimates of (1) original oil in place; (2) ultimate recovery; (3) remaining reserves; and (4) projected supply patterns. A discussion of the methodology for projecting supply patterns is also presented. This analysis does not include recoverable resources from nonconventional deposits such as tar sands and oil shale. The Republic of Venezuela ranked 7th in 1979 in production among the oil producers of the world and is one of the leading exporters of crude oil. During 1979, production averaged about 2.3 million (MM) barrels of oil per day (bopd). It exported an average of 1.2 MM bopd of crude oil in 1978 and 690 thousand (M) bopd of refined products during the first eleven months of 1978. Thus, it exported all but 12 to 13 percent of the petroleum produced in 1978; the rest is consumed domestically.

About 1/3 of the country's exports are received by the United States, and it was the 5th and 3rd largest supplier of crude oil and refined products to the United States in 1978 and 1979, respectively.

31635 **(PB—81-110306) An analysis of the Department of Energy's fuel allocation plan and related policies. Final report.** Solomon, S.; Revis, J.; Budin, D.; Pawela, J. (Institute of Public Administration, Washington, DC (USA)). Jun 1980. Contract SBA-2631-0A-79. 134p. NTIS, PC A07/MF A01.

The objective of this research program was to analyze the impact of the Department of Energy's fuel allocation regulations on the economic viability of small gasoline marketers. The first part of the study laid out the theoretical setting (microeconomics) of the fuel allocation regulation and developed the conceptual basis for impact analysis. In order to clearly understand the workings of the allocation regulations and how they affect the industry, a historical and institutional analysis of the gasoline industry was performed.

0208 Waste Management

31636 **(DOE/BC/10053—21) Analysis of potential used oil recovery from individuals. Final report.** Gottlieb, M. (Market Facts, Inc., Chicago, IL (USA)). Jul 1981. Contract AC19-79BC10053. 130p. NTIS, PC A07/MF A01. Order Number DE81029458.

To assist the Department of Energy in its investigation of methods for recycling used motor oil, Market Facts conducted a telephone survey of individuals who change their own motor oil. The study examined the amount of oil used, oil change practices, oil disposal methods, and perceptions and attitudes toward used motor oil disposal and oil recycling. The results of this survey are presented in this report. The findings of this study confirm the generally held view that about half the vehicle households in the United States now do their own oil changes and additions. These do-it-yourselfers (DIY) households account for almost two-thirds of the motor oil consumed by all US households and produce about one-third of one billion gallons of used motor oil annually. At least half of this used motor oil, more than 170 million gallons, is returned to the environment in a form that pollutes the ground and endangers the water supply. Measures such as requiring information about proper disposal and the need for recycling used oil to be printed on motor oil containers have been taken in many states. The need for reminder advertising and reinforcement education and information and practical measures to ease the burden of compliance is suggested. These results suggest that careful consideration be given to the logistics of these measures. The most appealing of the measures would appear to be making a special container available to DIY oil changers. Employing civic groups as collection agents would also seem to be attractive.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 32411

31637 **(AD-A—089335) Cargo fire hazards and hazard control for the supplement fuel supply assembly (SFSA). Final report, January-July 1980.** (Energy Analysts, Inc., Norman, OK (USA)). Aug 1980. Contract N68305-79-C-0021. 44p. NTIS, PC A03/MF A01.

This study evaluates potential fuel spills, spill fires and fuel spill hazards at a supplemental fuel supply installation. Potential fuel spill sources, probabilities and volumes are calculated. Consequences of these spills assuming spill ignition are quantified. Logistic support, manpower, and training needed to maintain the recommended spill control systems are detailed.

31638 **(DOE/EIS—0012-D) Petroleum production at maximum efficient rate. Naval petroleum reserve No. 1 (Elk Hills) Kern County, California. Draft environmental impact statement.** (Department of Energy, Washington, DC (USA)). Jun 1978. 377p. NTIS, PC E05/MF E05. Order Number DE81029850.

Pursuant to Public Law No. 94-258, the Naval Petroleum Reserves Production Act of 1976, the Naval Petroleum Reserves were opened up for production at maximum efficient rates (MER) consistent with sound engineering practices, for a period of 6 years. Additional open-up periods of 3 years each are also authorized if recommended by the President and approved by Congress. A major objective of this Act was to increase domestic petroleum production. Positive impacts of the project would be increased employment, use of vacant housing, increased local spending on goods and services, and the potential for increased domestic petroleum production with a commensurate decrease in the US balance of payment deficit. The achievement of increased production, however, is dependent on continued buyer interest. This continued interest may be questionable owing to the potential oil surplus situation on the west coast; maximum benefit from NPR-1 crude oil production will occur only if this oil surplus situation is resolved. Adverse effects of the project would include increased air pollution emissions, increased noise levels, reduction in vegetation, loss of the Petroleum Reserve for use in emergency situations, increased traffic levels, and decreased visual quality. It is anticipated that differential impacts of the project and alternatives could be significant enough to be controversial.

31639 **(FES—76/77-10) Final environmental impact statement for Ironton Mine.** (Federal Energy Administration, Washington, DC (USA)). Jul 1977. 556p. (FEA/S—77/205). NTIS, PC A24/MF A01. Order Number DE81029831.

This site-specific Environmental Impact Statement (EIS) has identified particularly sensitive environmental parameters that have been investigated in detail for the Ironton, Ohio Early Storage Reserve site. The most sensitive parameters to be affected by oil storage development at this site appear to be air quality and water quality. The significant adverse impacts to the physical environment that could result from the program include: locally significant increases in hydrocarbon emissions during transport of oil from the Gulf of Mexico to the Ironton Mine; degradation of surface water quality due to sedimentation from runoff and erosion during pipeline construction activities; and the potential for an increase in the frequency of oil spills along the transportation corridors. Changes in water quality would have a short term impact on the aquatic organisms in local areas. Oil spill releases to land and water environments would cause localized losses to vegetation and fauna along the pipeline corridor and at the terminals. The maximum estimated credible spill of 3000 barrels could severely pollute a local natural area of up to 100 acres and up to 15 miles of local stream channel, but the frequency of occurence of such a spill, based on historical data, is extremely low. No significant adverse socioeconomic impacts have been identified.

31640 **(PB—81-107971) Proposed 1979 outer continental shelf oil and gas lease sale offshore southern California. OCS sale No. 48. Volume 4. Final environmental statement.** (Bureau of Land Management, Los Angeles, CA (USA). Pacific Outer Continental Shelf Office). Jan 1979. 287p. NTIS, PC A13/MF A01.

The Environmental Statement considered all available data and evaluated potential effects of the proposed sale which might occur during exploration, development, and production of mineral resources.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 31635

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 32340

0230 Properties

REFER ALSO TO CITATION(S) 32294

31641 (AD-A—092799) Properties of regular and super unleaded automotive gasolines (Ottawa/Hull area-summer, 1979). Moroz, G.; Kallio, N.N.; Bailey, T.; Smith, S.A.; Des Brisay, C. (National Research Council of Canada, Ottawa, Ontario). Sep 1979. Translation of Canadian report. 12p. NTIS, PC A02/MF A01.

Unleaded, automotive, summer grade gasolines, both regular (type 2) and super (type 1), sold in the Ottawa/Hull area by the major oil companies are all excellent in quality. They meet requirements of CGSB Standards 3-GP-5 and 3-GP-5Ma for Unleaded Automotive Gasoline, except for some Reid vapour pressure values and one lead content that marginally exceed limits. The tested gasolines have nil or negligible lead and phosphorus contents indicating excellent protection against catalyst poisoning. Most gasolines have manganese, probably as the methylcyclopentadienyl manganese tricarbonyl antiknock agent.

31642 (AD-A—092789) Properties of regular and super unleaded automotive gasolines. Stringer, P.L.; Moroz, G.; Sabourin, R.; Burton, G.; Bailey, T. (National Research Council of Canada, Ottawa, Ontario). Jun 1979. AC Canadian report. 12p. NTIS, PC A02/MF A01.

Unleaded, automotive, winter grade gasolines, both regular (type 2) and super (type 1), sold in the Ottawa/Hull area by the major oil companies are all excellent in quality, meeting requirements of Canadian Government Specifications Board (CGSB) Standards 3-GP-5 and 3-GP-5Ma for Unleaded Automotive Gasoline. All the tested gasolines have nil or negligible lead and phosphorus contents indicating excellent protection against catalyst poisoning. Most gasolines have manganese, probably as the methylcyclopentadienyl manganese tricarbonyl antiknock agent.

0240 Storage

REFER ALSO TO CITATION(S) 31639

31643 (DOE/US—31017) DOE analysis of the appropriate size of the strategic petroleum reserve. (Wharton (E.F.A.), Inc., Philadelphia, PA (USA)). 30 Nov 1979. Contract AC01-81US31017. 76p. NTIS, PC A05/MF A01. Order Number DE81023577.

Conclusions of the analysis are: (1) US should proceed with the third 250 million barrels (MMB) in the Strategic Petroleum Reserve (SPR) to help assure adequate petroleum to maintain health, safety and national security in the event of a very severe interruption, and secondarily to reduce the severe economic impacts of even relatively small oil interruptions. (2) An SPR of a least 550 MMB is justified on other than economic grounds and that it should be developed as fast as possible to help assure that the US can survive a very severe interruption. A Primary Reserve of 550 MMB is necessary to assure petroleum for critical survival uses, including food, shelter, heat, medical care and national security. (3) The size of 550 MMB for the Primary Reserve assumes that the US could successfully reduce consumption of oil by 20 percent, through price increases, allocation and rationing, before critical needs were affected. A reduction of this size would entail major economic penalties in GNP loss and unemployment and would be very difficult to achieve, requiring a major improvement in the current capability of the government to implement such measures. (4) An additional 200 MMB in the SPR for a total of a least 750 MMB would be desirable to help avoid or reduce the economic losses caused by oil interruptions. A Secondary Reserve of this size would not be effective in avoiding all noncritical but painful economic losses because it would not be large enough to offset much of the cumulative oil shortfall in large interruptions and in smaller interruptions of extended duration. The economic impacts of a shortage of 200 MMB of oil in 1990 are estimated to be in the range of $40 to $50 Billion in GNP loss and 100,000 to 150,000 unemployed workers. (5) An incremental 200 MMB, for a total SPR of 750 MMB, would be economically beneficial.

31644 (DOE/US/08789—T1) Napoleonville dome brine injection feasibility and environmental assessment. Final report. (Dames and Moore, Atlanta, GA (USA)). 17 Nov 1978. Contract AC01-77US08789. 115p. NTIS, PC A06/MF A01. Order Number DE81027998.

The Napoleonville salt dome is one of five candidate sites in the Capline Group in SE Louisiana considered for the Strategic Petroleum Reserve. Brines will be produced by cavern leaching and oil displacement. This feasibility study showed that this brine should be disposed of by injection into saline aquifers at depths of -3000 to -8000 ft. (DLC)

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 31619

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 32453

31645 (DOE/BC/10005—5) Development of techniques for optimizing selection and completion of western tight gas sands. Phase V report, 1 June 1980-1 April 1981. Hodges, L.T.; Knutson, C.F.; Righter, S.B. (CK GeoEnergy Corp., Las Vegas, NV (USA)). Aug 1981. Contract AC08-79BC10005. 103p. NTIS, PC A06/MF A01. Order Number DE81030006.

Buried sandstone units of the Green River and Wind River Basins in Wyoming now exist as low permeability gas reservoirs of limited extent. The low permeability and limited extent have made gas production from these sandstone reservoirs difficult. This paper considers some of the factors that could contribute to the low permeability in these two basins. Micro-permeability measurements, thin section petrography, sedimentary structural element geometry, and sandstone unit orientation were employed in this study. Twenty sandstone outcrops were studied in the Green River Basin. Twelve sandstone outcrops were studied in the Wind River Basin (WRB). At least 10 shallow cores, each two feet in length, were cut at various vertical levels in each sandstone unit. In addition cores were cut in closely spaced grids from each formation. Although this study was made on outcrops that have undergone leaching, it is believed that the relationships found for the sedimentary elements and for the orientation and shape of the larger sandstone units (composed of the elements) should apply directly to the buried reservoir sandstone units. This study indicates that overall effective permeability of fluvial sandstones is complicated by many factors. Correlation of permeabilities measured within sedimentary elements and overall effective permeability of the unit has not been accomplished to date. Structural element boundaries and geometries, grain sizes, and diagenesis all have an influence. Rock permeability in wells can be improved by noting the nature of cements and diagenetic minerals present, and selecting fracturing and treating fluids which will not produce adverse reactions. Fracture treatment designs should take into account the geometry and directivity of the fluvial sandstone reservoir.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 31630, 31633

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 31633, 31772, 31926

31646 National fuel supply outlook for the 1980's. DeForest, W. pp 195-207 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

Forecasts of natural gas supplies are presented by a representative of the National Fuel Gas Supply Corporation. Sources of

gas supplies are described. Purchasing and storage of the gas are discussed. New sources for gas supplies, both domestic and foreign, are also discussed.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 31640

31647 **(AD-A—089315) The dissemination and combustion of unconfined liquefied natural gas clouds. Final report, 24 July-31 December 1978.** (Florida Univ., Gainesville (USA). Dept. of Zoology). May 1979. Contract DOT-CG-840700. 59p. NTIS, PC A04/MF A01.

A series of experimental tests were performed in the field to: (1) explosively disseminate liquefied natural gas (LNG) to form an unconfined cloud of measurable size and shape, (2) transfer a detonation wave from a different chemical cloud, but one known to support detonation, into an LNG cloud, and (3) observe and measure the effects of the transferred detonation wave in the unconfined LNG cloud. Based on the results of these feasibility tests, additional experiments are recommended. A two-cloud detonation transfer technique has been used to study the ability of an unconfined LNG cloud to support detonation. In this technique, two clouds are generated and the LNG cloud serves as the test cloud. The second cloud, the driver cloud, is composed of an easily detonable material and is used to generate the detonation wave. For these tests, propylene oxide was utilized as the driver cloud. A detonator in the driver cloud serves as the initiation source. High speed (about 4000 frames/second) and the medium speed (about 400 frames/second) cameras and pressure transducers served as diagnostics. The absolute radiometric output from the unconfined LNG cloud can be determined since calibration step wedges were used with films from selected cameras.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 32601

31648 **(BNL—51208) Long-range assessment of R & D policy for gas-related conversion technologies and unconventional natural gas resources.** Kydes, A.S.; Rabinowitz, J. (Brookhaven National Lab., Upton, NY (USA)). 25 Apr 1980. Contract AC02-76CH00016. 134p. NTIS, PC A07/MF A01. Order Number DE81030143.

This study analyzes the energy impacts on the US energy-economy system on a set of successful R & D programs. These programs are presumed to have led to the commercialization of innovative technologies that increase the US gaseous fuels resource base and promote the development of advanced natural gas conversion technologies for residential/commercial uses. The GRI and its principal subcontractor, TRW Incorporated, provided the detailed specifications of the energy conditions for both a Base Case and an R & D Policy Case. These conditions can be broadly categorized in terms of key energy resource price assumptions, energy resource availabilities, technology characterizations and market penetration guidelines for all energy technologies. Dale W. Jorgenson Associates (DJA) developed a set of demographic and economic projections including population, employment, and real GNP growth rates. The GRI and TRW staff provided the technology characterizations for most of the gas-related technologies and a number of other technologies. The data for the remaining technology characterizations were taken, for the most part, from Bhagat et al. This report presents the energy results from the BNL/DJA energy-economy system as executed under GRI specifications. It is intended to serve as a complement to the DJA report on the macro-economic consequences of these specifications. Certain assumption incorporated in the R & D and Base scenarios relating to market penetration were identified as particularly sensitive. In light of the uncertainty inherent in them, an additional set of sensitivity runs were requested by GRI and are presented in Appendix B.

31649 **(DOE/ET/27081—6) Geopressured-geothermal testing of five dry holes during 1980 and 1981.** Klauzinski, R.Z. (Eaton Operating Co., Inc., Houston, TX (USA)). 1981. Contract AC08-80ET27081. 10p. (CONF-811023—3). NTIS, PC A02/MF A01. Order Number DE81027581.

From 1981 SPE annual technical conference and exhibition; San Antonio, TX, USA (4 Oct 1981).

This paper summarizes the testing of five hot, geopressured aquifers in different geologic environments in Texas and Louisiana by Eaton Operating Company for the US Department of Energy. The results were encouraging. Natural gas-to-brine content ranged from 33.0 to 55.0 SCF/bbl. Gas production rates ranged from 93 to 600 MCFD. Sustained water production rates ranged from 1950 to 15,000 BWPD. Bottom-hole temperatures ranged from 260 to 327°F. Reservoir pressures ranged from 6627 psia to 13,203 psia. A test near Beaumont resulted in discovery of oil and gas.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 31651

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 31772

31650 **(LA-UR—81-2365) Cool-down flow-rate limits imposed by thermal stresses in LNG pipelines.** Novak, J.K.; Edeskuty, F.J.; Bartlit, J.R. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 8p. (CONF-810835—4). NTIS, PC A02/MF A01. Order Number DE81028731.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Warm cryogenic pipelines are usually cooled to operating temperature by a small, steady flow of the liquid cryogen. If this flow rate is too high or too low, undesirable stresses will be produced. Low flow-rate limits based on avoidance of stratified two-phase flow have been calculated for pipelines cooled with liquid hydrogen or nitrogen. High flow-rate limits for stainless steel and aluminum pipelines cooled by liquid hydrogen or nitrogen have been determined by calculating thermal stress in thick components vs flow rate and then selecting some reasonable stress limits. The present work extends these calculations to pipelines made of AISI 304 stainless steel, 6061 aluminum, or ASTM A420 9% nickel steel cooled by liquid methane or a typical natural gas. Results indicate that aluminum and 9% nickel steel components can tolerate very high cool-down flow rates, based on not exceeding the material yield strength.

31651 **(PB—81-109548) Requirements for the Federal Inspector Management Information System. Task 3 report. Final report.** (Touche Ross and Co., Washington, DC (USA)). 31 Aug 1980. Contract OFI-79-16279579. 450p. NTIS, PC A19/MF A01.

A report on the Management Information Systems requirements of the Federal Inspector's is presented. The nine proposed subsystems of the Federal Inspector's Management Information System (FIMIS) are described in functional terms. The contents of proposed inputs, processes and outputs are detailed. This report is the third in a series that describes the Federal Inspector's management processes and management information system requirements.

0350 Storage

31652 **(DOE/EIA—0239-80) Underground natural gas storage in the United States, 1980 to 1981 heating year (April 1980-March 1981).** Koelling, G.W. (Department of Energy, Washington, DC (USA). Office of Oil and Gas Resource Applications). Aug 1981. 29p. NTIS, PC A03/MF A01. Order Number DE81029909.

As of March 31, 1981, the end of the 1980 to 1981 heating year, the nation had 5248 billion cubic feet of natural gas in its underground storage reservoirs. Of this total, approximately 69.2 percent was base, or cushion gas and 30.8 percent was working gas.

Working gas in storage at the end of the 1980 to 1981 heating year totaled 1618 billion cubic feet, approximately 2.1 percent above that available at the beginning of the heating year. This increase resulted from an excess of storage injections over withdrawals (net injections) of 102 billion cubic feet during the heating year. These net injections also resulted in a 2.5 percent increase, to 3630 billion cubic feet, in the volume of base gas in storage. However, it should be noted that the total of working and base gas in storage at the end of the 1980 to 1981 heating year differs slightly from the sum of gas in storage at the beginning of the heating year and net injections during the year. This is due to changes and revisions in the quantities of native gas included in base gas and losses in base gas due to migration from storage reservoirs. All volumes of natural gas in this report are on a pressure base of 14.73 psia at 60 degrees Fahrenheit.

31653 **(DOE/RA/33008—1) Economic feasibility of inert cushions in underground gas storage.** (Lewin and Associates, Inc., Washington, DC (USA)). Sep 1980. Contract AC01-79RA33008. 50p. NTIS, PC A03/MF A01. Order Number DE81025914.

The physical properties of storage reservoirs and the economics of three major processes for generating inert gases (cryogenic nitrogen, engine exhaust gas and boiler flue gases) have been investigated and compared to the current practice of using natural gas as the cushion. Also studied are the effects of rising gas prices and potential changes in Federal policy (tax credit and income tax) on industry's decision to use inert cushions. The analysis indicated that the site is the most important factor in the decision to use inert gas as the cushion: the reservoir should minimize mixing between inert and natural gas; and the reservoir should be located close to an alternate use for the products of the inert gas generator. Under these conditions, cryogenic nitrogen would be preferred over natural gas for the cushion and could be implemented at gas prices from $2.60 to $3.40/Mcf. If mixing could not be prevented, gas prices from $3.20 to $4.40 would be required. If an alternate use could not be found, the exhaust gas case would be preferred at prices from $3.50 to $6.50/Mcf, in aquifer storage; and in depleted fields, prices range from $4.50 to $7.90. Extensive revision in the tax code would reduce these threshold prices by approximately $1.00/Mcf but would not alter the basic choices: mixing and alternative use would continue to dominate the decision.

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

REFER ALSO TO CITATION(S) 32599

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 31659, 32601

31654 **(DOE/ET/13090—T2) Posthydraulic fracture report.** Hecht-Nielsen, R. (Talley Energy Systems, Inc., Scottsdale, AZ (USA)). 4 Oct 1978. Contract AC03-78ET13090. 96p. NTIS, PC A05/MF A01. Order Number DE81029446.

A series of four, parallel, hydraulically induced hydrofractures were created. The hydrofractures will be used later in Phase I as the loading fractures for slurried explosives. An evaluation of the aerial extent, thickness, and resistance to air flow of each of these four fractures is reported. Downhole pressure, well-head pressure, surface resistivity, tiltmeter, hydrophone response, and crack opening measurements were used as dynamic tests to monitor and to later describe the hydrofracture. Downhole television, high-resolution seismic reflection survey (HRSRS), cross-hole seismic survey (CHSS), pressurized air-flow, tracer-gas flows, gamma-ray logging, and hydrogeologic monitoring were all used as posthydrofracture tests. Of all of these tests, tiltmeter, wellhead pressure, downhole television, pressurized air flows, and hydrogeologic monitoring were the most useful. Downhole pressure, crack opening, hydrophone response, tracer gas flow, and gamma-ray logging were less useful and provided only supportive data. HRSRS and CHSS provided no useful evaluation data. These evaluation tests showed the four hydrofractures to be narrow (≦ 0.01 inches) and horizontal; to extend out at least to the outer ring of production wells in a southeasterly direction; to extend beyond the outer ring of production wells in a northwesterly direction; to have some degree of vertical communication; to have had a minor impact upon the naturally fractured aquifer lying above the desired production zone; and to have had no impact on the naturally fractured aquifer lying below the desired production zone.

31655 **(SAND—81-0334C) Impulsive fracture and fragmentation of solids.** Grady, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810827—9). NTIS, PC A02/MF A01. Order Number DE81028251.

From 8. AIRAPT conference and 19. EHPRG conference; Uppsala, Sweden (17 Aug 1981).

A computational model for dynamic fracture and fragmentation has been described which is based on a nucleation and growth concept of fracture and developed within an internal state variable framework. The model is not yet consonant with all aspects of dynamic fracture but progress is encouraging and application to specific problems has been fruitful. Two specific deficiencies in the present and other fracture models have been noted. They are local microstructural inertia associated with dynamic fracture, and statistical consequences of fragmentation. Recent work has been focused on these particular problems and from this effort a clearer understanding of the requirements for a more complete dynamic fracture theory is emerging.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 31662

31656 **(DOE/LC/10747—T3) BX In Situ Oil Shale Project. Quarterly technical progress report, 1 March-31 May 1981.** Dougan, P.M. (Equity Oil Co., Salt Lake City, UT (USA)). 20 Jun 1981. Contract FC20-78LC10747. 132p. NTIS, PC A07/MF A01. Order Number DE81029781.

March 1, 1981-May 31, 1981 is the second quarter of continuous superheated steam injection at the BX In Situ Oil Shale Project. During the quarter, 122,749 barrels of water as steam were injected into Project injection wells at an average wellhead temperature of 757°F and an average wellhead pressure of 1381 psig. During the same period, 145,628 barrels of fluid were produced from the Project production wells for a produced to injected fluid ratio of 1.19 to 1.0.

31657 **(DOE/LC/10787—82) Investigation of the geokinetics horizontal in situ oil shale retorting process. Quarterly report, April-June 1981.** Gilbert, J.R. (Geokinetics, Inc., Concord, CA (USA)). Aug 1981. Contract FC20-78LC10787. 47p. NTIS, PC A03/MF A01. Order Number DE81028996.

Oil production from Retort No. 23 began on April 6, 1981. The retort burn front remained uniform with good vertical distribution as it advanced through the retort. During the burn various amounts of recycled off gas were introduced into the inlet injection stream. This was done to observe the effect on the retort burn. Preliminary indications are that the gas recycling had no obvious effect on the burn. Further evaluation from Sandia National Laboratories will be forthcoming. After burning 106 days, Retort No. 23 shut in at 9:30 A.M. on June 30, 1981. Total production for the life of Retort No. 23 was 991 barrels of shale oil. Total shale oil production from Retort No. 24 to date is 11,233 barrels. Retort No. 24 produced a total of 4701 barrels during the second quarter, an average of 52 barrels per day. Retort No. 24 has now burned for 211 days. On June 26, a new production well was drilled on Retort No. 24. This well was drilled slightly outside the retort boundary on the off gas end. The purpose of this action was to increase production life of the retort. During June the fire front advanced to the far off gas wells. Shale oil production totaled 5523 barrels during the second quarter. Blasthole drilling began on Retort No. 26. By the end of June 202 blastholes had been drilled. Four additional instrumentation wells were drilled on Retort No. 25. These wells will be used by Lawrence Livermore National Laboratory personnel

during electromagnetic testing which will assist in monitoring the burn front. Fabrication of the Retort No. 25 process equipment proceeded. Design of the Retort No. 25 instrumentation system was finalized and physical work began.

31658 **(EGG-FM—5517) Materials testing at the Vernal, Utah tar sands liquefaction site.** Loop, R.B. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1981. Contract AC07-76ID01570. 29p. NTIS, PC A03/MF A01. Order Number DE81028074.

General corrosion and U-bend and C-ring stress corrosion specimens were exposed in the product line at the Laramie Energy Technology Center's Vernal, Utah in situ tar sands liquefaction site. This test utilized steam injection to liquefy the entrapped bitumen which was then pumped to storage tanks. General corrosion resulting from exposure to these particular test conditions was negligible, with only the ferritic-steel specimens showing measurable corrosion. There was no indication of severe localized attack in the form of pitting or intergranular corrosion, no indication of stress corrosion cracking on any of the materials exposed, nor indication of any mineral particles in the product which would serve as a source of erosion.

31659 **(SAND—81-1659) Oil shale program. Twenty-first quarterly report, January 1981-March 1981.** Bader, B.E. (ed.). (Sandia Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 64p. NTIS, PC A04/MF A01. Order Number DE81030197.

In this report, SNLA in-house activities and field activities at the Geokinetics Oil Shale Project and the Occidental Oil Shale Project are described under the headings: bed preparation, bed characterization and evaluation, retort characterization and evaluation, and retort stability and integrity. These headings serve to identify major areas for study in the development of the technology leading to viable shale oil recovery operations.

31660 **(UCID—19168) Oil shale project run summary large retort Run L-2.** Raley, J.H.; Sandholtz, W.A.; Mallon, R.G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Aug 1981. Contract W-7405-ENG-48. 116p. NTIS, PC A06/MF A01. Order Number DE81028447.

The object of the L-2 Run was to determine the retorting behavior of individual oil shale blocks in a shale rubble matrix during simulated modified in-situ (MIS) combustion retorting. Conclusions are as follows: The interiors of large particles are delayed in retorting (compared to a surrounding matrix of small particles) by the greater lengths of the heat transports paths in the larger particles and their lower surface/mass ratio. In Run L-2 these delays were determined for six cylindrical blocks of three sizes surrounded by two different matrices. The delays resulted in oil being released from the blocks into an oil degrading environment in the rubble matrix. The combination of high interior block and matrix temperatures and oxygen presence at block surfaces during oil release caused the oil produced in block interiors to be degraded either in transport from the block interiors or in the rubble matrix. For three of the blocks, the fraction of generated oil that was degraded to light (C_1-C_4) hydrocarbons was determined from analysis of retort offgas produced during block retorting. The offgas ethene/ethane ratio was a sensitive indicator of oil degradation for all the blocks. High ethene/ethane ratios of intra of intra-retort gas sampled near the blocks the correlated with oxygen presence. The ethene/ethane ratios increased with both block size and matrix heating rate. This last factor was influenced by matrix size distribution, the bulk heating rate tending to be lower for the broader size range material.

0407 Health And Safety

REFER ALSO TO CITATION(S) 32411, 32583

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 32583

31661 **(DOE/ER/04960—2) Formation and transformation of organic species emitted from oil-shale conversion. Technical progress report.** Natusch, D.F.S. (Colorado State Univ., Fort Collins (USA). Dept. of Chemistry). Aug 1981. Contract AS02-78EV04960. 34p. NTIS, PC A03/MF A01. Order Number DE81028511.

For the last six years this program has had the following objectives: 1. To elucidate the processes which control the formation of particulate matter emitted to the atmosphere from coal combustion and oil shale retorting processes. 2. To identify the organic and inorganic species emitted to the atmosphere from coal combustion and oil shale retorting processes. 3. To elucidate the physical and chemical characteristics of particulate matter emitted from coal combustion and oil shale retorting process. 4. To establish the processes whereby organic species, present as vapor, become associated with particles following combustion and conversion processes. 5. To identify and quantify the transformations which particle-associated organic species undergo as a result of exposure to sunlight and to gases present in the plumes emitted from combustion and conversion processes of carbonaceous fuels. A summary of the research program as a whole is presented together with the results obtained during the preceding year.

31662 **(LBL—11819) Investigation of dewatering for the modified in-situ retorting process, Piceance Creek Basin, Colorado.** Mehran, M.; Narasimhan, T.N.; Fox, J.P. (Lawrence Berkeley Lab., CA (USA)). Oct 1980. Contract W-7405-ENG-48. 113p. NTIS, PC A06/MF A01. Order Number DE81029296.

The C-a and the C-b tracts in the Piceance Creek Basin are potential sites for the development of oil shale by the modified in-situ retorting (MIS) process. Proposed development plans for these tracts require the disturbance of over three billion m^3 (about six billion tons) of oil shale to a depth of about 400 m (1312 ft) or more below ground level. This disturbance will result in the modification of groundwater flows and fluid potentials and the alteration of the chemical and thermal regimes of native groundwaters. As a first step in evaluating the hydrogeologic consequences, the present study investigates the nature and impacts of dewatering and reinvasion that are likely to accompany the MIS process. Previous studies along these lines have been carried out by the US Geological Survey and others (i.e., Tipton and Kalmbach, Inc. and Golder Associates). The purpose of the present study is to extend these earlier investigations through more refined mathematical analysis. Physical phenomena not adequately covered in previous studies, particularly the desaturation process, are investigated. The present study also seeks to identify, through a parametric approach, the key variables that are required to characterize systems such as those at the C-a and C-b tracts. It is hoped that this study will eventually lead to the design of carefully controlled field experiments which will providethe critically required field data for long-term predictions.

31663 **(PB—81-129017) Reconnaissance study of leachate quality from raw mined oil shale - laboratory columns. Final report.** McWhorter, D.B. (Colorado State Univ., Fort Collins (USA). Dept. of Agricultural and Chemical Engineering). Dec 1980. 56p. NTIS, PC A04/MF A01.

This report presents the results of the chemical characterization of leachates generated from laboratory columns of several unretorted mined oil shales, unmined shales, and soils. The findings are indicators of the levels of common and trace species that can be expected to occur in field generated leachates.

05 NUCLEAR FUELS

0501 Reserves

31664 **(GJBX—269-81) Systems and economics for the estimation of uranium potential supply.** Harris, D.P.; Ortiz-Vertiz, R.; Chavex, M.L.; Agbolosoo, E.K. (Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering; Arizona Univ., Tucson (USA). Coll. of Mines). Jul 1981. Contract AC13-76GJ01664. 609p. NTIS, PC A99/MF A01. Order Number DE81029899.

This report consists of four parts, each one reasonably complete unto itself: Part I - Potential Supply Systems Based upon the Simulation of Sequential Exploration and Economic Decisions -- Systems Designed for the Analysis of NURE Endowment; Part II - Crustal Abundance and a Potential Supply System; Part III - An Investigation of Productivity and Technical Change in Exploration for and Production of Uranium; and Part IV - The Use of Solute Transport Models to Generate Geochemical Responses from a Hypothetical Uranium Deposit - An Early Effort in the Exploration Model Design. The bulk of this research was devoted to the design of potential supply systems. However, in that such systems require the modeling of exploration and exploitation, both of these activities were investigated as economic phenomena and as the subjects of models. Part I represents the largest of the research efforts. An attempt was made to design a system in which exploration is modeled in terms of both its efficiency and economics. While the exploration model demonstrated in this report is for roll-type sandstone deposits, this potential supply system, as a system per se, also applies to tabular deposits (San Juan Basin). Part II explores the concept of crustal abundance and existing crustal abundance models. The design of this crustal abundance potential supply system differs from that of any previously constructedcrustal abundance models in that it explicitly considers the third dimension, depth to deposit, and it places great emphasis upon the credible representation of the economics of exploration and exploitation. Part III reports on an attempt to measure the magnitude of technical change and depletion on the productivity of exploration and mining. This research examined these issues from the perspective of the economist, not the engineer. Part IV reports on an investigation of the feasibility of modeling the geochemical exploration for uranium, radon, and helium plumes. (DMC)

0502 Exploration

REFER ALSO TO CITATION(S) 31664, 32435, 32453

31665 **(GJBX—133-81) California-Nevada uranium logging. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Kleinfelder (J.H.) and Associates, Walnut Creek, CA (USA)). Apr 1981. Contract AC13-76GJ01664. 196p. NTIS, PC A09/MF A01. Order Number DE81028527.

The purpose of this project was to obtain geophysical logs of industry drill holes to assess the uranium resource potential of geologic formations of interest. The work was part of the US Department of Energy's National Uranium Resource Evaluation (NURE) Program. The principal objective of the logging program was to determine radioelement grade of formations through natural gamma ray detectors. Supplementary information was obtained from resistivity (R), self-potential (SP), point resistance (RE), and neutron density (NN) logs for formation interpretation. Additional data for log interpretation was obtained from caliper logs, casing schedules, and downhole temperature. This data was obtained from well operators when available, with new logs obtained where not formerly available. This report contains a summary of the project and data obtained to date.

31666 **(GJBX—200-81) Exploration systems approach to the Spokane Mountain area uranium deposits, Northeastern Washington.** Babcock, L.; Beck, P.; Farley, W.; Lechler, P.; Lindgren, J.; Miller, D.; Pigott, J.; Sayala, D.; Trujillo, R.; Wayland, T. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Jul 1981. Contract AC13-76GJ01664. 533p. NTIS, PC E16/MF A01. Order Number DE81029788.

Includes 1 sheet of 24x reduction microfiche.

Within the gross context of economic exploration techniques developed through case studies of known mineralization, this report of research into the Spokane Mountain uranium deposit integrates the results of numerous field surveys and the application of proven scientific methods with the effects of all tasks weighed against those of similar activities and the costs of alternative methods. An exploration systems approach to the problem required a synthesis of information derived mainly from a small mining district in Stevens County, Washington. Data were obtained by utilizing sources of information available to the mineral industry and state-of-the-art uranim exploration techniques, including geological, geophysical, geochemical, and emanometric procedures. The Spokane Mountain mineralization exemplifies classical conditions of uranium deposits that form in the contact zone developed between metasediments and uraniferous intrusive rocks. Geological studies for this report include assessments of subsurface conditions; interpretations of detailed petrographic examinations that emphasize depositional environments, metamorphic effects, alteration, paragenesis, mineralogy, and origin; and overviews of regional stratigraphy, structure, metamorphism, plutonium, and metallogeny. Elements and minerals associated with uranium were detected along the contact zone, Midnite Trend, using geochemical techniques applied to both soils and stream surveys. The coincidence of molybdenum and uranium in the sediments and water of streams in the Spokane Mountain area indicates a nearby source of uranium. The abundance of multielements such as U, As, and F in the soils, checked at various densities and scales, are indicators of uranium mineralization; also, two targets with uranium potential apparently exist in areas peripheral to Spokane Mountain.

31667 **(GJBX—242-81) Investigation of the application of $^{4}He/^{36}Ar$ ratio and ^{222}Rn measurements to the exploration for uranium mineral deposits. Final report.** Schutz, D.F. (Bendix Field Engineering Corp., Grand Junction, CO (USA); Teledyne Isotopes, Westwood, NJ (USA)). Jun 1981. Contract AC13-76GJ01664. 212p. (IWL—5810-450). NTIS, PC A10/MF A01. Order Number DE81028163.

The sites of three uranium ore deposits of diverse geologic settings have been studied by a limited sampling of near-surface and subsurface soil gas, soil, and core materials to determine whether the uranium decay products ^{226}Ra, ^{222}Rn, ^{210}Pb, and ^{4}He may be useful as indicators of subsurface uranium mineralization. It was concluded that in the near-surface environment of all three sites, the ^{222}Rn levels were less than would be expected from closed system equilibrium with the soil itself and any anomalies with the underlying ore is fortuitous and does not provide a basis for guiding an exploration drilling operation. In contrast to the results for ^{222}Rn, the results for adsorbed ^{210}Pb show a number of locations with ^{210}Pb concentrations in the near-surface environment in excess of that expected from closed systems accumulations. However, the value of ^{210}Pb measurements as indicators of subsurface uranium deposits is considered inconclusive by the author. Radium-226 distributions in the near-surface samples at the three sites do not show significant patterns that are related to underlying ore. Most soil-gas samples have $^{4}He/^{36}Ar$ ratios significantly in excess of atmospheric levels. However, the lack of consistent relation to uranium mineralization either in areal or vertical distribution, coupled with the ability to measure excess ^{4}He in soils not associated in any way with uranium mineralization leads to the interpretation that much, if not all of the excess ^{4}He measured in soil gas is the result of in situ formation and not from allogenic sources. (DMC)

31668 **(GJBX—250-81) Hydrogeochemical and stream sediment reconnaissance basic data for Utukok River Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 99p. (K/UR—350). NTIS, PC E04/MF A01. Order Number DE81028165.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 578 water samples from the Utukok River Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

31669 **(GJBX—251-81) Hydrogeochemical and stream sediment reconnaissance basic data for De Long Mountains Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 102p. (K/UR—351). NTIS, PC E05/MF A01. Order Number DE81025860.

Includes 1 sheet of 48 reduction microfiche.

Field and laboratory data are presented for 626 water samples from the De Long Mountains Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

31670 **(GJBX—271-81) Hydrogeochemical and stream sediment reconnaissance basic data for Milbank NTMS Quadrangle, Minnesota; North Dakota; South Dakota.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Jun 1981. Contract W-7405-ENG-26. 258p. (K/UR—156). NTIS, PC A12/MF A01. Order Number DE81029657.

Results of a reconnaissance geochemical survey are reported for the Milbank Quadrangle, Minnesota; North Dakota; South Dakota. Statistical data and areal distributions for uranium and uranium-related variables are presented for 662 groundwater and 319 stream sediment samples. Also included is a brief discussion on location and geologic setting.

31671 **(GJBX—274-81) Hydrogeochemical and stream sediment reconnaissance basic data for Broken Bow NTMS Quadrangle, Nebraska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 206p. (K/UR—26). NTIS, PC A10/MF A01. Order Number DE81030295.

Results of a reconnaissance geochemical survey of the Broken Bow Quadrangle, Nebraska, are reported. Statistical data and areal distributions for uranium and uranium-related variables are presented for 578 groundwater and 442 stream sediment samples. Also included is a brief discussion on location and geology. Groundwater data indicate that uranium concentrations above the 85th percentile occur primarily in the southeastern and central portion of the quadrangle. Isolated samples also occur in the eastern and southwestern portions. Water containing high concentrations of uranium are predominantly in the Pliocene Ogallala Formation. High uranium concentrations also are found in waters derived from the Niobrara Chalk and alluvial deposits. High uranium concentrations are associated with high values of specific conductance, boron, calcium, potassium, lithium, magnesium, sodium, strontium, and total alkalinity. Stream sediment data indicate that uranium concentrations above the 85th percentile occur in randomly scattered sediments, with no apparent trends visible. Sediments with high uranium values are derived primarily from glacial and alluvial deposits. Sediments with high U-FL values are associated with high values of chromium, lithium, iron, magnesium, scandium, yttrium, and zirconium. Sediments with high U-NT values are generally associated with high values of cerium, titanium, and zirconium.

31672 **(GJBX—283-81) Norfolk and southern eastville 1^0 x 2^0 NTMS areas Virginia and North Carolina. Data report (abbreviated).** Cook, J.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jun 1981. Contract AC09-76SR00001. 18p. (DPST—81-146-10). NTIS, PC E02/MF A01. Order Number DE81029895.

Includes 7 sheets of 24x reduction microfiche.

This abbreviated data report presents results of ground water and stream sediment reconnaissance in the National Topographic Map Series (NTMS) Norfolk 1^0 x 2^0 quadrangle and the southern one-half of the Eastville 1^0 x 2^0 quadrangle. Surface sediment samples were collected at 840 sites. Ground water samples were collected at 1008 sites. Neutron activation analysis (NAA) results are given for uranium and 16 other elements in sediments, and for uranium and 8 other elements in ground water. Field measurements and observations are reported for each site. Analytical data and field measurements are presented in tables and maps. Data from ground water sites include: (1) water chemistry measurements (pH, conductivity, and alkalinity); (2) physical measurements, where applicable (water temperature, well description, etc.); and (3) elemental analyses (U, Al, Br, Cl, Dy, F, Mn, Na, and V). Data from sediment sites include: (1) stream water chemistry measurements (pH, conductivity, and alkalinity); and (2) elemental analyses for sediment samples (U, Th, Hf, Al, Ce, Dy, Eu, Fe, La, Lu, Mn, Sc, Sm, Na, Ti, V, and Yb). Sample site descriptors (stream characteristics, vegetation, etc.) are also tabulated. Areal distribution maps, histograms, and cumulative frequency plots for most elements and for U/Th and U/Hf ratios are included. Uranium concentrations in the sediments that were above detection limits ranged from 0.60 to 40.2 ppM. The mean of the logarithms of the uranium concentrations was 0.61. A large area of high uranium concentrations occurs in the southwestern part of the Norfolk quadrangle. High concentrations of thorium and hafnium in the same area indicate that the uranium is associated with the resistate minerals monazite and zircon.

31673 **(GJBX—288-81) Hydrogeochemical and stream sediment reconnaissance basic data for Hobbs quadrangle, New Mexico; Texas.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 127p. (K/UR—340). NTIS, PC E06/MF A01. Order Number DE81029972.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 284 water samples and 559 sediment samples from the Hobbs Quadrangle, New Mexico; Texas. Uranium values have been reported by Los Alamos National Laboratory in Report GJBX-103(78). The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

31674 **(GJBX—289-81) Hydrogeochemical and stream sediment reconnaissance basic data for Ogden Quadrangle, Utah; Wyoming.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 30 Jun 1981. Contract W-7405-ENG-26. 124p. (K/UR—367). NTIS, PC E05/MF A01. Order Number DE81029983.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 123 water samples and 749 sediment samples from the Ogden Quadrangle, Utah and Wyoming. Uranium values have been reported by Los Alamos National Laboratory in Report GJBX-70(78). The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

31675 **(GJBX—290-81) Hydrogeochemical and stream sediment reconnaissance basic data for Ruby Quadrangle, Alaska.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 31 Jul 1981. Contract W-7405-ENG-26. 104p. (K/UR—354). NTIS, PC E01/MF A01. Order Number DE81029982.

Includes 1 sheet of 48x reduction microfiche.

Field and laboratory data are presented for 693 water samples from the Ruby Quadrangle, Alaska. The samples were collected by Los Alamos National Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

0503 Mining

31676 **(PB—81-128969) Field test of hydraulic borehole mining systems in shallow uranium sands. Final report Jun 77-Sep 78.** Archibald, W.R. (Flow Industries, Inc., Kent, WA (USA)). Sep 1978. Contract H0272010. 217p. NTIS, PC A10/MF A01.

This report presents the results of a program demonstrating the technical and economic feasibility of hydraulic borehole mining of uraniferous sandstone. A high-pressure cutting jet and a slurry jet pump make up the borehole mining tool, which is lowered down a borehole into the uranium-bearing sandstone. Water from the cutting jet cuts into the sandstone formation generating a water-sand slurry which is pumped to the surface, thereby forming a cavity in the formation. When the cavity size reaches a point beyond the effective radius of the cutting jet, the mining tool is moved to an adjacent borehole and the process is started again.

0504 Feed Processing

31677 **Extraction of radionuclides from low-grade ores and mill tailings. Final report, February 15, 1980-February 15, 1981.** Torma, A.E. Sante Fe, New Mexico; New Mexico Energy and Minerals Department (1981). 38p. (NP—1903909; EMD—2-68-3320).

The purpose of this research project is to develop efficient leaching processes for the extraction of uranium from low-grade ores and for the removal of long half-life radionuclides (radium and thorium) from the leach residue in order to produce innocuous tailings. The present investigation is the first part of a three-year project. It provides kinetic information not heretofore available for uranium leaching by hydrochloric and sulfuric acid solutions and preliminary data for the removal of radionuclides from the leach

residues by KCl-solutions. This study has demonstrated that uranium extractions as high as almost 100% can be realized with either HCl or H_2SO_4 leach solutions. Initial radium concentration of 245 pCi g^{-1} originally in the ore was reduced to 70 and 23 pCi g^{-1} in the final tailings of hydrochloric and sulfuric acid leachings.

0505 Enrichment

REFER ALSO TO CITATION(S) 31755, 31756, 31757

31678 **(DOE/EP—0029) Environmental readiness document advanced isotope separation program.** (Teknekron, Inc., McLean, VA (USA)). Aug 1981. Contract AC01-79EV10292. 56p. NTIS, PC A04/MF A01. Order Number DE81029952.

Advanced Isotope Separation (AIS) techniques hold the promise of significantly reducing the cost of enriching uranium for use in commercial nuclear power reactors. By reducing uranium enrichment costs, the tails assay of an enrichment plant can be lowered resulting in a decrease in the requirements for natural uranium feed material and a small decrease in the cost of the electricity produced by nuclear power plants. With this increased efficiency of uranium enrichment, there will be an overall reduction in the environmental impacts associated with uranium processing in the front end of the fuel cycle. AIS is characterized by much lower energy requirements compared to diffusion; comparable energy requirements to centrifuge; generally similar offsite environmental and socioeconomic impacts to centrifuge; and substantially fewer secondary impacts than diffusion because of reduced need for power. In the broadest definitions of environmental concerns, the socio-political and security aspects of proliferation and safeguards are the most significant in reducing AIS to practice. The potential exists for exposure of plant workers or offsite personnel to radioactive material or process chemical during normal or accident conditions. Some AIS processes make use of strong magnetic or electromagnetic fields and lasers, and methods are required to monitor the levels of these radiations. The AIS processes will routinely generate chemical and radioactive wastes. Additional wastes may be generated during plant decontamination and decommissioning. All of these wastes must be managed to meet Federal and state requirements. Finally, based on preliminary designs, some of the AIS processes may require significant, relative to US and world supply, quantities of a coating material.

31679 **(K/OA—5013) Procedures for the calculation of the separative performance of a countercurrent gas centrifuge.** Von Halle, E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jul 1981. Contract W-7405-ENG-26. 71p. (CONF-810845—1). NTIS, PC A04/MF A01. Order Number DE81025448.

From 4. workshop on gases in strong rotation; Oxford, UK (24 Aug 1981).

The standard Onsager-Cohen gradient equation predicts reasonably well the separative performance of a gas centrifuge in which half the machine operates as an enriching section and half the machine operates as a stripping section and in which both the enricher and stripper contain several theoretical separation stages. This is due in part to the fact that the approximations used in the development of the standard Onsager-Cohen gradient equation produce results which depart from the more detailed solutions presented in one direction in the enriching section and in the other direction in the stripping section and the errors therefore tend to cancel for the machine as a whole. It follows that for a centrifuge in which most of the bowl is used as an enriching section or as a stripping section this cancellation would not occur and some appreciable error would result from the use of the standard Onsager-Cohen gradient equation. A modified Onsager-Cohen gradient equation is therefore recommended in preference to the standard Onsager-Cohen gradient equation. This equation is developed for the general case in section III.C of this report and for the more specific case under consideration in section IV.C. It is shown in the results of calculations that indeed very little effect is observed by neglecting the term in the gradient equation containing the second derivative of the concentration.

31680 **(LA-tr—81-20) Gas centrifuge.** Kanda, H. (Los Alamos National Lab., NM (USA)). 1981. Translation of . Japanese Patent 1977-78,981. 4p. NTIS, PC A02/MF A01. Order Number DE81028976.

The design is based on a pair of upper and lower bearings in a sealed vacuum tank, a revolving hub fitted by an axle to each bearing, and a molecular pump. (DLC)

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 31688, 31757, 32291, 32445

31681 **(DOE/ET/34215—26) Fuel-performance improvement program. Thermal conductivity of sphere-pac fuel.** Ades, M.J. (Consumers Power Co., Jackson, MI (USA); Exxon Nuclear Co., Inc., Richland, WA (USA)). Jul 1981. Contract AC02-76ET34215. 79p. NTIS, PC A05/MF A01. Order Number DE81028115.

Progress in understanding the thermal conductivity of sphere-pac fuel beds has been made both at Oregon State University and Exxon Nuclear Company supported by the Fuel Performance Improvement Program (FPIP). Purpose of the program is to test and demonstrate improved light water reactor fuel concepts that are more resistant to failure from pellet-cladding interaction during power increases than standard pellet fuel. 22 figures, 2 tables.

31682 **(DOE/SF/01435—T4) Gas cooled fast reactor fuel cost assessment. Final report, October 1978-September 1979.** Thompson, M.L. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1979. Contract AC03-77SF01435. 72p. NTIS, PC A04/MF A01. Order Number DE81029338.

Two factory sizes, 250 and 25 MTHM/year, were considered for fuel assembly fabrication cost assessment. The work on this program involved utilizing GE LMFBR cost assessment and fuel factory studies experience to provide a cost assessment of GCFR fuel assembly fabrication. The recent impact of highly sensitive safety and safeguards environment policies on fuel factory containment, safety, quality assurance and safeguards costs are significantly higher than a few years ago. Fuel assembly fabrication costs represent an estimated 30 to 60% of the total fuel cycle costs. In light of the relative high cost of fabrication, changes in the core and assembly design may be necessary in order to enhance the overall fuel cycle economics. Fabrication costs are based on similar operations and experience used in other fuel cycle studies. Because of extrapolation of present technology (e.g., remote fuel fabrication versus present contact fabrication) and regulatory requirements, conservative cost estimates were made. The fabrication costs are calculated based on an equation developed by HEDL.

31683 **(DOE/SF/71031—T4) Secure automated fabrication (SAF). Phase I interim report: a systems analysis.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1979. Contract AT03-76SF71031. 116p. NTIS, PC A06/MF A01. Order Number DE81029330.

An advanced Secure Automated Fabrication (SAF) System is being developed for mixed uranium and plutonium fuel fabrication. SAF System development will ultimately result in systems which maximize personnel radiation protection, restrict and control access to SNM material, improve containment and detection systems for nuclear materials, provide adequate SNM accountability and improve product uniformity and quality. A systems requirement analysis study was initiated to establish the consistent and objective set of requirements within which the choice among alternatives represents the balanced viewpoints of performance, achievability and risk.

31684 **(ORNL/TM—7684) Evaluation of gravimetric and volumetric dispensers of particles of nuclear material.** Bayne, C.K.; Angelini, P. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 65p. NTIS, PC A04/MF A01. Order Number DE81029099.

Theoretical and experimental studies compared the abilities of volumetric and gravimetric dispensers to dispense accurately fis-

sile and fertile fuel particles. Such devices are being developed for the fabrication of sphere-pac fuel rods for high-temperature gas-cooled light water and fast breeder reactors. The theoretical examination suggests that, although the fuel particles are dispensed more accurately by the gravimetric dispenser, the amount of nuclear material in the fuel particles dispensed by the two methods is not significantly different. The experimental results demonstrated that the volumetric dispenser can dispense both fuel particles and nuclear materials that meet standards for fabricating fuel rods. Performance of the more complex gravimetric dispenser was not significantly better than that of the simple yet accurate volumetric dispenser.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 31703, 31757, 31763, 32386

31685 **(DOE/EV/70037—T4) Hallam fuel decladding. Program summary report.** Dennison, W.F. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 1 Apr 1980. Contract AT03-76EV70037. 63p. NTIS, PC A04/MF A01. Order Number DE81029439.

This report summarizes the program of decladding the 150 Hallam fuel assemblies, removal of the sodium, and the packaging and shipment of the recovered fuel to Savannah River for eventual reprocessing.

31686 **(DP-MS—81-14) Plutonium scrap recovery at the Savannah River Plant.** Gray, L.W. (Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA). Atomic Energy Div.). 1981. Contract AC09-76SR00001. 25p. (CONF-810813—13). NTIS, PC A02/MF A01. Order Number DE81026548.

From National American Chemical Society summer meeting; New York, NY, USA (23 Aug 1981).

Processing of plutonium began at the Savannah River Plant (SRP) during 1953. Since that time, SRP has recovered plutonium from waste streams, analytical wastes, solids collected in tanks, filters, and vents, and solids shipped to SRP from other sites. The scrap has varied from 99^{+}% Pu metal to materials containing < 1% Pu. Regardless of the type material involved, initial processing of each scrap material is designed to transform the plutonium to a solution that is compatible with one of the solvent extraction cycles of the Purex process. Various chemical methods have been used to convert scrap materials to compatible solutions. The schemes may include combinations of total dissolution or selective dissolution of either the Pu or the contaminants; selective precipitation of contaminants; and selective adsorption of Pu on either anion or cation resins by selective masking of various ions. A representative sampling of the recovery system developed for use at SRP is presented in this paper. The list is not exhaustive, nor are the methods necessarily the only or even the best methods to use. However, these methods give high recovery of Pu, can be used in the available equipment within the plutonium glove-boxes, and produce solutions which can be transferred directly to the Purex solvent extraction cycles for final purification and finishing.

31687 **(GA-A—16405) Spent graphite fuel element processing.** Holder, N.D.; Olsen, C.W. (General Atomic Co., San Diego, CA (USA); Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Jul 1981. Contract AT03-76SF71053. 20p. (CONF-810941—2). NTIS, PC A02/MF A01. Order Number DE81029746.

From ANS technical base for nuclear fuel cycle policy; Newport, RI, USA (20 Sep 1981).

The Department of Energy currently sponsors two programs to demonstrate the processing of spent graphite fuel elements. General Atomic in San Diego operates a cold pilot plant to demonstrate the processing of both US and German high-temperature reactor fuel. Exxon Nuclear Idaho Company is demonstrating the processing of spent graphite fuel elements from Rover reactors operated for the Nuclear Rocket Propulsion Program. This work is done at Idaho National Engineering Laboratory, where a hot facility is being constructed to complete processing of the Rover fuel. This paper focuses on the graphite combustion process common to both programs.

31688 **(HEDL-SA—2327) Dissolution of COPRECAL mixed-oxide fuel.** Patridge, J.A.; Lerch, R.E.; Bosuego, G.P. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1981. Contract AC14-76FF02170. 23p. (CONF-810606—93). NTIS, PC A02/MF A01. Order Number DE81028205.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Conclusions based on this investigation of continuous coprecipitation-calcination (COPRECAL) mixed oxide (MOX) dissolution are as follows: (1) A large fraction of the COPRECAL MOX dissolved very rapidly in nitric acid alone. Appeoximately 95% of the powder tested dissolved in the first 5 to 6 minutes in boiling 8 to 12M nitric acid. The remainder dissolved much more slowly, with greater than 99% dissolved after 8 hours. The dissolution rate increased slightly as the nitric concentration was increased from 8 to 12M. (2) Of the fuel fabrication operations investigated, only the sintering operation had a significant effect on the dissolution rate. In tests with samples from a fuel fabrication run, the sintered pellet samples had approximately one-tenth as much residue remaining at the end of 6- and 12-hour tests in 12M nitric acid compared to the MOX powder starting material. (3) The presence of Pu and U in the nitric acid dissolvent had very little effect on the dissolution rate. In tests with Pu-U nitrate-nitric acid solution as the dissolvent, the final 5% of the COPRECAL sample dissolved slightly slower than it had in tests with nitric acid only as the dissolvent. (4) The plutonium-uranium ratio was higher in the final residue than in the starting material. At the end of a 6-hour dissolution test in 10M nitric acid the Pu-U ratio in the residue was 4 vs 0.25 in the starting material. (5) A final residue of undissolved oxide can be expected in the Wet Scrap Development Laboratory (WSDL) dissolver. As a way to minimize the buildup of undissolved MOX powder in the continuous dissolver, all scrap material could be subjected to high temperature sintering (e.g., ~ 1700°C) prior to processing through WSDL.

31689 **(PB—81-850687) Spent nuclear fuel recovery. May, 1972-February, 1980 (citations from the NTIS Data Base). Report for May 72-Feb 80.** Stratton, T.G. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 111p. NTIS PC N01/MF N01.

This bibliography discusses the reprocessing of spent nuclear fuel with specific emphasis on cost factors, technology, methods, handling, management, environmental impacts, and the nuclear fuel cycle. (Contains 106 citations.)

0509 Transport And Storage

REFER ALSO TO CITATION(S) 31741, 31750, 31751, 31758, 31762, 31764

31690 **(AGNS—47921-3026-TPR-18) Demonstrate fuel disassembly/encapsulation. Technical progress report, April 1981-June 1981.** (Allied-General Nuclear Services, Barnwell, SC (USA)). 3 Aug 1981. Contract AC09-79ET47921. 10p. NTIS, PC A02/MF A01. Order Number DE81027944.

Work on this project is focused on demonstrating disassembly and encapsulation of nuclear fuels as a means to increase spent fuel storage. The effort commenced on April 17, 1980, and is progressing satisfactorily. The Equipment/Procedure Preparation subtask is essentially complete. The Equipment Demonstration sub-task and the Process Assessment Studies sub-task continue. The equipment design effort associated with the first sub-task, the component testing and checking associated with the second sub-task, and the technical studies and investigations associated with the latter subtask continue to verify the feasibility of this concept to enhance the use of fuel storage resources.

31691 **(AGNS—47921-TPR-17) AFR spent-fuel-storage program. Technical progress report, April 1981-June 1981.** (Allied-General Nuclear Services, Barnwell, SC (USA)). 3 Aug 1981. Contract AC09-79ET47921. 17p. NTIS, PC A02/MF A01. Order Number DE81027945.

Work on this project is focused on developing design and licensing information for the model facility. Final deliverables were prepared this period to submit to DOE for the licensing and high-

density rack sub-tasks. DOE revised and reduced the scope of the 1981 AFR contract in June of 1981. Work is progressing satisfactorily to close out the remaining tasks under the revised scope by September 30, 1981.

31692 (BAW—1645-1) Critical experiments supporting underwater storage of tightly packed configurations of spent fuel rods. Technical progress report, July 1-September 30, 1980. Hoovler, G.S.; Baldwin, M.N. (Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div.). Feb 1981. Contract AC09-79ET47923. 23p. NTIS, PC A02/MF A01. Order Number DE81029643.

Critical arrays of 2.5%-enriched UO_2 fuel rods that simulate underwater rod storage of spent power reactor fuel are being constructed. Rod storage is a term used to describe a spent fuel storage concept in which the fuel bundles are disassembled and the fuel rods are packed into specially designed cannisters. Rod storage would substantially increase the amount of fuel that could be stored in available storage space. These experiments are providing criticality data against which to benchmark nuclear codes used to design tightly packed rod storage racks.

31693 (BAW—1645-2) Critical experiments supporting underwater storage of tightly packed configurations of spent fuel rods. Hoovler, G.S.; Baldwin, M.N. (Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div.). Apr 1981. Contract AC09-79ET47923. 14p. NTIS, PC A02/MF A01. Order Number DE81029641.

Criticla arrays of 2.5%-enriched UO_2 fuel rods that simulate underwater rod storage of spent power reactor fuel are being constructed. Rod storage is a term used to describe a spent fuel storage concept in which the fuel bundles are disassembled and the rods are packed into specially designed cannisters. Rod storage would substantially increase the amount of fuel that could be stored in available space. These experiments are providing criticality data against which to benchmark nuclear codes used to design tightly packed rod storage racks.

0510 Marketing And Economics

31694 (GJO—01664) Statistical data of the uranium industry. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). 1 Jan 1981. Contract AC13-76GJ01664. 97p. NTIS, PC A05/MF A01. Order Number DE81026863.

Data are presented on US uranium reserves, potential resources, exploration, mining, drilling, milling, and other activities of the uranium industry through 1980. The compendium reflects the basic programs of the Grand Junction Office. Statistics are based primarily on information provided by the uranium exploration, mining, and milling companies. Data on commercial U_3O_8 sales and purchases are included. Data on non-US uranium production and resources are presented in the appendix. (DMC)

31695 (PNL-SA—9520) Use of asphalt emulsion sealants in disposal of uranium mill tailings. Hartley, J.N.; Freeman, H.D.; Elmore, M.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 10p. (CONF-810730—2). NTIS, PC A02/MF A01. Order Number DE81028019.

From 1981 national conference on environmental engineering; Atlanta, GA, USA (8 Jul 1981).

Studies of asphalt emulsion sealants conducted by the Pacific Northwest Laboratory have demonstrated that the sealants are effective in containing radon within uranium tailings. The laboratory and field studies have further demonstrated that radon exhalation from uranium tailings piles can be reduced by greater than 99% to near background levels. Field tests at the tailings pile in Grand Junction, Colorado confirmed that an 8-cm admix seal containing 22 wt % asphalt could be effectively applied with a cold-mix paver. Other techniques were successfully tested, including a soil stabilizer and a hot, rubberized asphalt seal that was applied with a distributor truck. After the seals were applied and compacted, overburden was applied over the seal to protect the seal from ultraviolet degradation.

0520 Waste Management

REFER ALSO TO CITATION(S) 31677, 31691, 31692, 31693, 31750, 31751, 31752, 31758, 31759, 31762, 31764, 32050, 32055, 32075, 32259, 32269, 32277, 32282, 32446, 32447, 32470, 32539, 32601

31696 (ORNL-tr—4772) Storage and solidification of MAW/LAW in underground cavities. First semiannual report for 1980. Hauser, W.; Smailos, E. (Oak Ridge National Lab., TN (USA)). [nd]. Translation source information not available . 21p. NTIS, PC A02/MF A01. Order Number DE81028710.

The following two areas are discussed in this report: calculation of temperature changes in the product and in the surrounding rock salt; and calculations of the radiation exposure to test personnel in the leaching of 200 l cement products with activity tracers. Some of the highlights are: temperatures calculated with the three-dimensional program are consistent with the previous unidimensional calculations; calculation of the temperature changes in the product based on the new cement data led to a reduction in the maximum temperature of approximately 25% in comparison with the previous calculations (from 110°C to 80°C); in the computer model used here, a reduction in the product temperature from 40°C to 25°C when storage in the cavern was carried out caused a reduction in the maximum cavern temperature of approximately 10% (from 80°C to 71°C).

31697 (ORNL-tr—4757) [Storage and solidification of MAW/LAW in underground cavities]. Interaction between waste product and salt; experiments aimed at sealing caverns; examinations of cavern models. (Oak Ridge National Lab., TN (USA)). [nd]. Translation source information not available . 26p. NTIS, PC A03/MF A01. Order Number DE81028709.

The following areas are covered in this report: interaction between waste product and salt; experiments aimed at sealing of caverns; and examination of cavern models. Studies after 56 days of storage in saliferous rocks yielded the following results: (1) When PZ 35 F, API/Class G and blast furnace slag cement are used, compression strength values decrease when MAW is used as the make-up solution and the elasticity modulus rises. This may result in a certain amount of embrittlement of the samples. In the case of magnesite cement, no tests could be performed because, when MAW solution is used, this type of cement does not set within 56 days. (2) Addition of a cement sealing agent and water glass causes the strength values to increase, with a simultaneous decrease of the elasticity modulus and pore radii. This results in a partial compensation for the adverse effects of MAW on the mechanical characteristics [of the samples]. (3) Addition of sand does not improve mechanical characteristics; it can, however, replace cement as a filler. (4) When blast furnace slag cement is used as a binder, within 56 days a build-up of an approximately 10 mm boundary layer in the contact area with salt containing Friedel's salt appears. The effects of Friedel's salt are under examination. (5) After 56 days in samples containing PZ 35 F, the strength values are lower than in those containing G class API and blast furnace slag cement.

31698 (ORNL-tr—4759) [Storage and solidification of MAW/LAW in underground cavities]. Experiments with solidified radwaste. Uerpmann, E.P. (Oak Ridge National Lab., TN (USA)). [nd]. Translation source information not available . 11p. NTIS, PC A02/MF A01. Order Number DE81028711.

This report discusses the following experiments on leaching of cement, solidified radioactive wastes: preparation of the experimental area on the 490 m floor of the Asse salt mine; removal of casings; determining leaching rate of $NaNO_3$; and leaching with inactive cesium.

31699 (ANL—80-121) Comparison of costs for solidification of high-level radioactive waste solutions: glass monoliths vs metal matrices. Jardine, L.J.; Carlton, R.E.; Steindler, M.J. (Argonne National Lab., IL (USA)). May 1981. Contract W-31-109-ENG-38. 155p. NTIS, PC A08/MF A01.

A comparative economic analysis was made of four solidification processes for liquid high-level radioactive waste. Two proc-

esses produced borosilicate glass monoliths and two others produced metal matrix composites of lead and borosilicate glass beads and lead and supercalcine pellets. Within the uncertainties of the cost (1979 dollars) estimates, the cost of the four processes was about the same, with the major cost component being the cost of the primary building structure. Equipment costs and operating and maintenance costs formed only a small portion of the building structure costs for all processes.

31700 **(DOE/EIS—0082) Defense-Waste-Processing Facility, Savannah River Plant, Aiken, SC: Draft environmental impact statement.** (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 467p. NTIS, PC E05/MF E05. Order Number DE81028349.

The purpose of this Environmental Impact Statement (EIS) is to provide environmental input into both the selection of an appropriate strategy for the permanent disposal of the high-level radioactive waste (HLW) currently stored at the Savannah River Plant (SRP) and the subsequent decision to construct and operate a Defense Waste Processing Facility (DWPF) at the SRP site. The SRP is a major US Department of Energy (DOE) installation for the production of nuclear materials for national defense. Approximately 83 x 10^3 m^3 (22 million gal) of HLW currently are stored in tanks at the SRP site. The proposed DWPF would process the liquid HLW generated by SRP operations into a stable form for ultimate disposal. This EIS assesses the effects of the proposed immobilization project on land use, air quality, water quality, ecological systems, health risk, cultural resources, endangered species, wetlands protection, resource depletion, and regional social and economic systems. The radiological and nonradiological risks of transporting the immobilized wastes are assessed. The environmental impacts of disposal alternatives have recently been evaluated in a previous EIS and are therefore only summarized in this EIS.

31701 **(DOE/ET/41900—6) Characteristics of candidate geologies for nuclear waste isolation: a review.** Johnston, R.G.; Palmer, R.A. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). 15 Aug 1981. Contract AC09-79ET41900. 86p. (ESG-DOE—13346). NTIS, PC A05/MF A01. Order Number DE81030153.

Basalt, granite, salt, shale, and tuff formations have been proposed as sites for geologic disposal of high-level nuclear waste. The choice of site will affect the design of the waste package and the accompanying engineered barriers; thus, it is important to know the general properties of each type of repository rock in order to tailor an effective waste isolation system. In this document, the stratigraphy, chemical and mineral composition, hydrology, and physical properties of each rock type are summarized. Most of the data are site-specific and, in some cases, preliminary. More detailed analyses from other sources are expected to be available at a later date. 88 references.

31702 **(DPST—80-249) Environmental information document defense waste processing facility.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Jul 1981. Contract AC09-76SR00001. 1073p. NTIS, PC A99/MF A01. Order Number DE81028345.

This report documents the impact analysis of a proposed Defense Waste Processing Facility (DWPF) for immobilizing high-level waste currently being stored on an interim basis at the Savannah River Plant (SRP). The DWPF will process the waste into a form suitable for shipment to and disposal in a federal repository. The DWPF will convert the high-level waste into: a leach-resistant form containing above 99.9% of all the radioactivity, and a residue of slightly contaminated salt. The document describes the SRP site and environs, including population, land and water uses; surface and subsurface soils and waters; meteorology; and ecology. A conceptual integrated facility for concurrently producing glass waste and saltcrete is described, and the environmental effects of constructing and operating the facility are presented. Alternative sites and waste disposal options are addressed. Also environmental consultations and permits are discussed.

31703 **(ENICO—1085) Effect of concentration of the height of a transfer unit in a liquid/liquid solvent-extraction system.** Chamberlain, D.B. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). May 1981. Contract AC07-79ID01675. 116p. NTIS, PC A06/MF A01. Order Number DE81029784.

Pulsed, sieve-plate extraction columns were used to examine the effect of solute concentration on extraction efficiency. Cerium was extracted from an aqueous coprocessing solution, simulating reprocessing wastes produced at the Idaho Chemical Processing Plant. The organic extractant used in this process was dihexyl-N, N-diethylcarbamylmethylene phosphonate. Subsequently, cerium was stripped from the organic phase with 0.05 M nitric acid. The Heights of a Transfer Unit were calculated from the extraction and stripping column operating data. Both interstage and overall transfer units were calculated. Nine extraction and nine stripping tests were performed. Three extraction feed concentrations, each repeated at three different pulse frequencies were used to study the affect of concentration on height of a transfer unit. The stripping column was operated simultaneously with the extraction column. Both columns were operated at pulse amplitudes of 2.5 cm. Data based upon the overall extraction column showed a slight decrease in the height of a transfer unit as the solute concentration decreased. Based upon the overall stripping column data, a decrease in solute concentration resulted in a very slight increase in the height of a transfer unit. However, interstage transfer unit calculations for both columns indicated solute concentration had no significant effect on the height of a transfer unit. Based on the experimental tests, it was concluded that solute concentration caused only slight changes in extraction efficiency for the concentration range studied. Other factors such as pulse frequency, aqueous/organic flow ratio, and possibly the dispersed phase bubble size had a much greater effect on the extraction efficiency for the system studied.

31704 **(LBL—11143) Backfill barriers: the use of engineered barriers based on geologic materials to assure isolation of radioactive wastes in a repository.** Apps, J.A.; Cook, N.G.W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1981. Contract W-7405-ENG-48. 9p. (CONF-801124—53). NTIS, PC A02/MF A01. Order Number DE81028049.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

A preliminary assessment is made to show that canisters fabricated of nickel-iron alloys, and surrounded by a suitable backfill, may produce an engineered barrier where the canister material is thermodynamically stable with respect to its environment. As similar conditions exist in nature, the performance of such systems as barriers to isolate radionuclides can be predicted over very long periods, of the order of 10^6 years.

31705 **(NVO—196-25) Nevada nuclear waste storage investigations. Quarterly report, January-March 1981.** (Department of Energy, Las Vegas, NV (USA). Nevada Operations Office). Jun 1981. 76p. NTIS, PC A05/MF A01. Order Number DE81029877.

The results and observations of studies performed in the development of technologies for nuclear waste storage and disposal and the study of underground rock media on or adjoining the Nevada Test Site (NTS) are highlighted in this report. Petrological studies of drill core from exploratory hole USW-G1 at Yucca Mountain have been completed. The interpretation of the geophysical logs for UE25a-4, -5, -6, and -7 taken in Drill Hole Wash at Yucca Mountain was completed. Hydrologic testing of well USW-H1 at Yucca Mountain was completed. Preliminary results indicate that the rocks between a depth of 1900 feet and about 2300 feet are fairly permeable, but very little permeability was found at greater depths. The character of late Pleistocene rat middens in the vicinity of some large washes and fossil travertine deposits at the NTS indicate that these habitats, which are below 4000 feet in elevation, have been essentially dry over the last 50,000 years. Reconnaissance geochemical studies suggest that a significant mantle metasomatic event occurred in the Crater Flat area at about 4 to 5 million years ago, an event that is recorded in basalt chemistry by a sharp increase in trace element abundances. Eleven samples of zeolitically altered tuffs from drill hole USW-G1 at Yucca Mountain were ana-

lyzed for radioactive disequilibrium in the uranium-decay series to indicate paleohydrologic activity. The final Project-wide concurrence on the Site Evaluation Working Group's area-to-location screening method was obtained and initial phases of implementation were achieved. The scope of work was agreed upon and contract work was initiated for the evaluation of water resources and utilization in the southwestern NTS and surrounding areas. A parametric porous-medium study of hydrothermal convection in response to high-level nuclear waste emplacement was completed. The first of a series of planned spent fuel canister exchanges was successfully completed in January.

31706 **(ONWI—64) Analysis of interactions of mechanical deformations and mass transfer on heat transfer from an underground nuclear-waste repository. Final report.** Bloom, S.G.; Hulbert, L.E. (Battelle Columbus Labs., OH (USA)). Oct 1979. Contract AC06-76RL01830. 40p. NTIS, PC A03/MF A01. Order Number DE81029461.

A review of existing models identified several effects that may need consideration in further model development. Most of these effects involved coupling equations through variable property values rather than through omission of any significant mechanism. However, it was also shown that more than one mechanism may adequately simulate a given set of experimental data and additional experimental data are needed to establish which (if any) of the possible mechanisms would actually control conditions in a nuclear waste repository. In particular, it is believed that mathematical modeling of major thermomechanical effects can be accomplished with finite element analysis computer programs, provided that adequate thermomechanical property data of salt and overburden are attained. An attempt was made to develop a general set of differential equations for simulating momentum, mass, and energy flows in geologic formations in order to illustrate the possible mechanisms and point out those included and not included in existing models. Most of the mechanisms are included in some manner in existing models although some approximations may not be adequate. More experimental data are required to assess the importance of most omitted mechanisms. Analysis of some data on brine migration in salt indicated that two mechanisms, acting simultaneously, could adequately explain the flow. These are Darcy flow and a combination of ordinary and thermal diffusion enhanced by temperature-dependent solubility. Equations based on this simultaneous action correlated the data very well and indicated the possible need to include both (and, maybe other) mechanisms in future models. A program is recommended for further study of brine mobility. An expected result of this program includes recommendations for further experimental work.

31707 **(PNL—3741) Behavior of radioactive iodine and technetium in the spray calcination of high-level waste.** Knox, C.A.; Farnsworth, R.K. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01. Order Number DE81028405.

The Remote Laboratory-Scale Waste Treatment Facility (RLSWTF) was designed and built as a part of the High-Level Waste Immobilization Program (now the High-Level Waste Process Development Program) at the Pacific Northwest Laboratory. In this facility, which is installed in a radiochemical cell, small volumes of radioactive liquid wastes can be solidified, the process off gas can be analyzed, and the methods for decontaminating this off gas can be tested. Initial operations were completed with nonradioactive, simulated waste solutions (Knox, Siemens and Berger 1981). The first radioactive operations in this facility were performed with a simulated, commercial waste composition containing tracer levels of ^{99}Tc and ^{131}I. This report describes the facility and test operations and presents the results of the behavior of ^{131}I and ^{99}Tc during solidification of radioactive liquid wastes. During the spray calcination of commercial high-level liquid waste spiked with ^{99}Tc and ^{131}I, there was a 0.3 wt% loss of particulates, a 0.15 wt% loss of ^{99}Tc and a 31 wt% loss of ^{131}I past the sintered-metal filters. These filters and a venturi scrubber were very efficient in removing particulates and ^{99}Tc from the off-gas stream. Liquid scrubbers were not efficient in removing ^{131}I, as 25% of the total lost went to the building off-gas system. Therefore, solid adsorbents will be needed to remove iodine. For all future RLSWTF operations where iodine is present, a silver zeolite adsorber will be used.

31708 **(PNL—3818) Defense waste vitrification studies during FY 1980.** Bjorklund, W.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 91p. NTIS, PC A05/MF A01. Order Number DE81029616.

During FY-1980, Pacific Northwest Laboratory (PNL) tested three vitrification processes on simulated high-level radioactive waste typical of that stored or being produced at US defense facilities. Processes tested included a spray calciner/in-can melter, spray calciner/ceramic melter and direct liquid feeding of a ceramic melter. Tests were made on pilot-scale as well as fullscale equipment. Over 16,000 kg of glass product were produced from 68,000 L of simulated waste. Several compositions were tested, and the glass products were evaluated. Emphasis was placed on determining the processing rates and the ability of the waste to be processed. Off-gas data were collected on several runs. Major conclusions drawn from this test program are divided into processing results, glass-product results, and general information.

31709 **(PNL—3898) Application of a site-binding, electrical, double-layer model to nuclear waste disposal.** Relyea, J.F.; Silva, R.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1981. Contract AC06-76RL01830. 28p. NTIS, PC A03/MF A01. Order Number DE81030231.

A site-binding, electrical, double-layer adsorption model has been applied to adsorption of Cs for both a montmorillonite clay and powdered SiO_2. Agreement between experimental and predicted results indicates that C/sub s/$^+$ is adsorbed by a simple cation-exchange mechanism. Further application of a combination equilibrium thermodynamic model and site-binding, electrical, double-layer adsorption model has been made to predict the behavior of U(VI) in solutions contacting either the montmorillonite clay or powdered SiO_2. Experimentally determined U solution concentrations have been used to select what is felt to be the best available thermodynamic data for U under oxidizing conditions. Given the existing information about the probable U solution species, it was possible to determine that UO_2^{+2} is most likely adsorbed by cation-exchange at pH 5. At higher values (pH 7 and 9), it was shown that $UO_2(OH)_2^0$ is probably the most strongly adsorbed U solution species. It was also found that high NaCl solution concentrations at higher pH values lowered U concentrations (either because of enhanced sorption or lowered solubility); however, the mechanism responsible for this behavior has not been determined.

31710 **(PNL-SA—9094) Dealing with regional hydrologic data-base limitations. Case example: the Columbia River basalts.** Schalla, R.; Leonhart, L.S. (Battelle Pacific Northwest Labs., Richland, WA (USA); Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1981. Contract AC06-76RL01830. 15p. (CONF-810372—12). NTIS, PC A02/MF A01. Order Number DE81030086.

From Symposium on uncertainties associated with the regulation of the geologic disposal of high-level radioactive waste; Gatlinburg, TN, USA (9 Mar 1981).

Limitations are encountered in assembling hydrologic data for a broad geographic region, such as the Columbia Plateau in the northwestern US, into a conceptual model of the hydrologic system. These limitations may become resonant in subsequent numerical simulations of hydrologic system behavior. Included among such data limitations are irregular spatial distributions of data, decreases in information with increasing depth from the land surface, uncertainties about the reliability of reported hydrologic data, disparities in time-dependent parameters, and lack of field verification of data. The preparation of a regional hydrologic system description, therefore, first involves a comprehensive data evaluation, wherein the data are classified and ranked in terms of their utility to the study. The results of this evaluation are essential in planning future data acquisition activities, as well as in selecting and developing models. In turn, iterative use of modeling, data refinement, and data acquisition is considered to be highly effective. The case example of preparing a hydrologic system description for the Columbia Plateau, as required for repository siting, illustrates methods of determining the accuracy of certain data, compensating for data limitations, evaluating the need for acquiring additional data, and refining data through iterative techniques. Emphasis is placed on professional subjectivity, which has proven to be essential in data base evaluation and refinement.

31711 **(PNL-SA—9111) Assessment of effectiveness of geologic isolation systems: the AEGIS geologic simulation model.** Foley, M.G.; Petrie, G.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 17p. (CONF-810372—11). NTIS, PC A02/MF A01. Order Number DE81028007.

From Symposium on uncertainties associated with the regulation of the geologic disposal of high-level radioactive waste; Gatlinburg, TN, USA (9 Mar 1981).

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Assessment of the post-closure performance of a nuclear waste repository has two basic components: the identification and analysis of potentially disruptive sequences and the pattern of geologic events and processes causing each sequence, and the identification and analysis of the environmental consequences of radionuclide transport and interactions subsequent to disruption of a repository. The AEGIS Scenario Analysis Task is charged with identifying and analyzing potenially disruptive sequences of geologic events and processes. The Geologic Simulation Model (GSM) was developed to evaluate the geologic/hydrologic system surrounding an underground repository, and describe the phenomena that alone, or in concert, could perturb the system and possibly cause a loss of repository integrity. The AEGIS approach is described in this report. It uses an integrated series of models for repository performance analysis; the GSM for a low-resolution, long-term, comprehensive evaluation of the geologic/hydrologic system, followed by more detailed hydrogeologic, radionuclide transport, and dose models to more accurately assess the consequences of disruptive sequences selected from the GSM analyses. This approach is felt to be more cost-effective than an integrated one because the GSM can be used to estimate the likelihoods of different potentially disruptive future evolutionary developments within the geologic/hydrologic system. The more costly consequence models can then be focused on a few disruptive sequences chosen for their representativeness and effective probabilities.

31712 **(RFP—3132) Volume reduction of used high-efficiency particulate air (HEPA) filters.** Buttedahl, O.I. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 3 Aug 1981. Contract AC04-76DP03533. 15p. NTIS, PC A02/MF A01. Order Number DE81028529.

A device was designed and constructed to reduce the volume of used high efficiency particulate air (HEPA) filters from air filtration systems. A pilot model of a three-axis hydraulic compactor was developed for compacting 8 x 8 x 6 in. filters. The model was used to demonstrate that HEPA filter volume reductions in excess of 90% can be achieded. With the encouraging results obtained from the pilot model, a production model was built to accept Size 5 HEPA filters, which measure 2 x 2 x 1 ft. Use of the production model will provide significant savings in both waste packaging and terminal waste storage.

31713 **(RFP—3210) Recovery of plutonium from nitric-acid waste streams.** Navratil, J.D.; Martella, L.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1981. Contract AC04-76DP03533. 12p. (CONF-810813—10). NTIS, PC A02/MF A01. Order Number DE81028420.

From National American Chemical Society summer meeting; New York, NY, USA (23 Aug 1981).

Nitric acid (7M) waste streams at Rocky Flats contain 0.01 to 0.001 g/l plutonium and new processes are under development to reduce the plutonium levels to 10^{-6} g/l. Anion exchange and solvent extraction methods are under evaluation. Several macroreticular and microreticular anion exchange resins were evaluated and Rohm and Hass (IRA-938) gave significant improvement in plutonium capacity and elution over several other resins tested. The solvent extraction process uses dihexyl-N, N-diethylcarbamylmethylene phosphonate extractant. The results of recent tests using a combined anion exchange extraction chromatography process will be described for recovering both plutonium and americum.

31714 **(RHO-SA—203) Effect of pH on the destruction of complexants with ozone in Hanford nuclear waste.** Winters, W.I. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Jun 1981. Contract AC06-77RL01030. 100p. (CONF-8106119—2). NTIS, PC A05/MF A01. Order Number DE81029493.

From Northwest regional American Chemical Society meeting; Bozeman, MT, USA (17 Jun 1981).

Chemical processing of nuclear waste at Hanford has generated some waste solutions with high concentration (0.1 to 0.5M) of N-(hydroxyethyl)-ethylenediaminetriacetic acid (HEDTA), ethylenediaminetetraacetic acid (EDTA), and other organic complexing agents. These complexants must be destroyed bacause they affect radionuclide migration in soils, waste concentration, radionuclide removal, and other waste storage and processing considerations. Previous studies on actual waste solutions demonstrated that preozonation of the alkaline waste significantly improved radionuclide removal. A series of bench-scale experiments using synthetic waste has been performed to determine the optimum pH for most efficient ozone destruction of EDTA. Ozonation of EDTA in synthetic waste was carried out over the pH range of 1 to 14. Potential catalytic materials were examined at different pH levels. The EDTA-ozone reaction rates and stoichiometric requirements were compared and evaluated for the varying conditions.

31715 **(RHO-SA—210) Saturated-column leach studies: Hanford 216-Z-1A sediment.** Delegard, C.H.; Gallagher, S.A.; Kasper, R.B. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1981. Contract AC06-77RL01030. 7p. (IAEA-SM—257/47P; CONF-810722—10). NTIS, PC A02/MF A01. Order Number DE81029485.

From International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle; Knoxville, TN, USA (27 Jul 1981).

A previous laboratory study indicated that Pu and Am in the waste discharged to the crib would not be sorbed on the sediment but migrate with the waste solution. Field study of the TRU distribution beneath the crib support the conclusions of the laboratory study. The current laboratory study indicates that waste-sediment interactions have altered the waste, resulting in the retention of almost all of the Pu and most of the Am on the sediment tested. Batch leaching study results, in agreement with results of an earlier study, show Am concentrations are determined by an Am compound having pH dependent solubility. Batch studies also show that Pu is not present in the sediment sample as PuO_2. The mechanism of Pu solution is ion exchange desorption. The solubility of TRU can be enhanced under column leaching conditions which favor concentration of complexing agents at the wetting front. Plausible environmental leaching conditions might be expected to mobilize less than 1% of the Pu present in the sediment and approximately 30% of the Am.

31716 **(RHO-ST—35) Fission product sorption parameters for Hanford 200 area sediment types.** Routson, R.C.; Barney, G.S.; Smith, R.M.; Delegard, C.H.; Jensen, L. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Jun 1981. Contract AC06-77RL01030. 67p. NTIS, PC A04/MF A01. Order Number DE81029459.

Studies were conducted to measure the Hanford Site 200 Separation Areas sorption properties for trace strontium (^{85}Sr), cesium (^{137}Cs), and cobalt (^{60}Co). Scintillation logs of ground disposal facilities and particle size plus calcium carbonate sediment data were used to independently delineate sediment types. Good agreement was found between the sediment types from the two methods. Twenty-one sediment types were delineated from five wells.

31717 **(SAND—81-0427) Proceedings of the sixth annual NEA-seabed working group meeting, Paris, France.** Anderson, D.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 220p. (CONF-810259—). NTIS, PC A10/MF A01. Order Number DE81028246.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

Major objectives of this year's meeting are: to exchange data and information collected during 1980; to outline each participant's seabed disposal program status and specific plans for next year; to coordinate this year's cooperative work, including research vessel cruises; to review the System Analysis Task Group (SATG) report and to provide further information for the SATG models; and to outline the major tasks and timing for the Seabed Working Group programs for the next five years. The end product of the workshop is to have a basis for: A summary report to the NEA Radioactive Waste Management Committee on the SWG activities; Identification of specific areas of continued Task Group coordination; An update of specific Task Group members; and Identification of specific areas of continued multinational participation. Separate abstracts have been prepared for the individual task groups' reports for inclusion in the Energy Data Base. National summary reports on the status of programs in the USA, United Kingdom, France, Japan, Canada, Netherlands, Commission of the European Communities, Federal Republic of Germany, Switzerland, and Belgium are included. (DMC)

31718 (SAND—81-0427, pp 37-92) **System analysis task group.** Jul 1981. NTIS, PC A10/MF A01.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

At this meeting, the main tasks of the study group were to discuss their task report with other task groups and to formulate the five-year research program, including next year's plans. A summary of the discussion with other task groups is presented. The general objective of the five-year program is to gather all elements necessary for a decision on the technical feasibility of the subseabed option. In addition, site selection criteria consistent with both radiological assessment and engineering capability will be produced. The task group report discussed radiological assessments, normal or base-case assessments, operational failures, low-probability postdisposal events, engineering studies, radiological criteria, legal aspects, social aspects, institutional aspects, generic comparison with other disposal options, and research priorities. The text of the report is presented along with supporting documents. (DMC)

31719 (SAND—81-0427, pp 93-142) **Site selection task group.** Jul 1981. NTIS, PC A10/MF A01.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

National reports from Canada, France, Japan, Netherlands, the United Kingdom, and the USA summarizing findings in bathymetry, seismic surveys, geochemistry, heat transfer, oceanography, and stratigraphy undertaken in behalf of the subseabed program are presented. A review of generally accepted site criteria and the present status of study locations are included. The five-year site selection research plan consists of 4 phases: (1) Use existing geophysical/geological and oceanographic knowledge to define regions (large areas several degrees on a side) which might contain areas of suitable characteristics. (2) Use archive geophysical/geological data and new reconnaissance data to identify smaller study areas (locations in US terminology) within the regions. (3) Conduct detailed geophysical and sampling programs within the areas, including Gloria or Seabeam surveys, near-bottom surveys, and heatflow investigations. Profiling 2 kHz or 3.5 kHz is essential at this stage. (4) In areas which have not been rejected on the basis of earlier work, check deeper sediment type and geological history by deep coring. Any area still appearing suitable after this would become a candidate disposal site (though this does not necessarily rule out the need for further studies).

31720 (SAND—81-0427, pp 153-168) **Physical oceanography task group.** Jul 1981. NTIS, PC A10/MF A01.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

Statements of progress made during the past year and research plans for the next 12 months were considered during the meeting of the physical oceanography task group. Reports were given by representatives of the Federal Republic of Germany, France, Japan, Netherlands, Switzerland, United Kingdom, and the USA. A summary of the 5 year oceanography research plan is included. (DMC)

31721 (SAND—81-0427, pp 169-180) **Sediment and rock task group.** Jul 1981. NTIS, PC A10/MF A01.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

Progress accomplished during the past year was summarized during the meeting of the Sediment and Rock Task Group. Information needs from other task groups are indicated. Reports were given by representatives of the following countries: Canada, France, Netherlands, United Kingdom, and the USA. (DMC)

31722 (SAND—81-0427, pp 181-194) **Waste form and canister task group.** Jul 1981. NTIS, PC A10/MF A01.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

This task group met as a whole and as waste form and canister subtask groups. Two main topics were reviewed during the course of the waste form subtask group discussions: the identification of the parameters that should be determined during the next five years and the development of the various national programs both underway and in planning stages. Many of the parameters given to the System Analysis Task Group (SATG) model were still considered applicable. However, the most important of these, that of the leach rate, was now thought to be incorrect. The true relationship will be determined only by experiments where access of water is restricted and leaching is by diffusion through layers of sediment and corrosion products of the canister. The leaching then will probably be restricted by the saturation of the leachant with silica and will be much lower than in the excess water case, previously determined. Most of the discussions addressed only vitrified high-level waste. Since the US Subseabed Disposal Program has at this time no funds specifically designated for either waste form development or assessment, future experimental programs would probably be largely French work, with some input from the CEC and possibly the UK. The objective of the work underway and planned by the Canister Task Group members is to specify materials and fabrication techniques for the production of a containment system which will isolate the waste from the disposal environment for a period of time on the order of 500 to 1000 years.

31723 **(SAND—81-1095-Vol.2) Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.** Hinga, K.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 880p. NTIS, PC A99/MF A01. Order Number DE81029363.

Volume II of the sixth annual report describing the progress and evaluating the status of the Subseabed Disposal Program contains the appendices referred to in Volume I, Summary and Status. Because of the length of Volume II, it has been split into two parts for publication purposes. Part 1 contains Appendices A-Q; Part 2 contains Appendices R-MM. Separate abstracts have been prepared for each appendix for inclusion in the Energy Data Base.

31724 (SAND—81-1095-Vol.2, pp 9-24) **Subseabed disposal safety analysis.** Koplik, C.M.; Ensminger, D.A. (Analytic Sciences Corp., Reading, MA). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The safety analysis program plan concerning the acceptability of subseabed disposal of nuclear wastes is described in this appendix. An overview of the subseabed systems analysis effort is also provided.

31725 (SAND—81-1095-Vol.2, pp 25-50) **Initial phase of the subseabed thermal sensitivity studies.** Klett, R.D. (Sandia Labs., Albuquerque, NM). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The initial phase of the thermal sensitivity study is described in this appendix. Sensitivity studies are performed and combined to formulate constraints, requirements, and responses for the system of subseabed nuclear waste disposal. The reference repository consists

of a single vertically oriented, HLW or PWR spent fuel canister in a penetrator buried 30 m deep on a 200 m square grid in red clay sediments located in the North Pacific mid-ocean gyre. The results of thermal studies conducted using the MARIAH computer program are presented. (DMC)

31726 (SAND—81-1095-Vol.2, pp 51-60) **Significant times for ion transport systems study in the SDP. Appendix C.** Klett, R.D. (Sandia Labs., Albuquerque, NM). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The need for standardization of definitions in the parameter of time for ions to migrate from a nuclear waste disposal canister, through the disposal media to a mobile fluid is discussed in this appendix. The three ion times identified and defined are: breakthrough time, release duration, and peak release time. Equations are included.

31727 (SAND—81-1095-Vol.2, pp 61-72) **Titanium alloy suitability for subseabed environment. Appendix D.** Schaefer, D.; Glass, R.S.; Abrego, L.; Rack, H.J. (Sandia National Labs., Albuquerque, NM). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

Corrosion and stress corrosion examinations of TiCode-12 (ASTM Gr. 12) and commercial purity titanium (ASTM Gr. 2) have been conducted. The data from these experiments, many from severe overtests, continue to show that TiCode-12 still remains as a viable candidate material for long-term waste isolation.

31728 (SAND—81-1095-Vol.2, pp 73-242) **Sediment-seawater interaction at 200° and 300°C, 500 bars pressure: chemical exchange and hydrothermal alteration.** Seyfried, W.E.; Thornton, E.C. (Univ. of Minnesota, Minneapolis). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The results of a series of experiments conducted at 200° and 300°C and 500 bars and at a water/rock mass ratio of 5 are reported and discussed in order to document chemical exchange and mineralogical modification between sediment and seawater during hydrothermal interaction. Sediments utilized were obtained from the MPG-I region in the North Pacific. Experimental conditions were chosen to simulate the near field chemical environment. Changes in solution composition indicate similar modifications of major element chemistry in all experiments. Redox reactions critically affected alteration processes. These typically involved reduction of MnO_2 components of the sediment by small but nevertheless significant amounts of organic carbon and ferrous iron. Mineralogical changes for smectite-rich sediment involved the production of smectite at the expense of a mixed smectite-illite component and amorphous material. Clinoptilolite dissolved entirely while plagioclase and chlorite reacted to a moderate extent. A program of development and testing of hydrothermal equipment designed for the study of the migration of radionuclides in a thermal gradient has demonstrated that a uniform and reproducible gradient can be maintained between 300° and 100°C at 500 bars. Details of operation are discussed and a proposed research program of radionuclide mobilization in the near- to far-field environment is outlined.

31729 (SAND—81-1095-Vol.2, pp 243-252) **Temperature and pH effects on sorption properties of subseabed clay.** Kenna, B.T. (Sandia National Labs., Albuquerque, NM). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The radionuclide sorption properties of a smectite subseabed clay for cesium (Cs), strontium (Sr), europium (Eu), and barium (Ba) were studied as functions of time, pH, and temperature using batch equilibrium techniques. All of the elements reached sorption equilibrium within 4 days and Cs was the only one not exhibiting pH dependence. Sorption of Cs is inversely dependent on temperature, whereas the others show little or no dependence. The K/sub d/ for the elements are listed for the above elements at 20°C and 60°C. The initial concentrations are also given to allow intercomparison with other work. The values appear to be consistent with those reported in the literature for Cs, Sr, Eu, and Ba. Ion exchange may be the primary sorption mechanism for Cs, but there appears to be other mechanisms for the sorption of Ba, Sr, and Eu on subseabed sediments. Significant pH effects were measured for the sorption of the latter elements on subseabed sediments.

31730 (SAND—81-1095-Vol.2, pp 253-266) **Effect of radiolysis on the oxidation state of neptunium in seawater.** Nash, K.L.; Fried, S.; Friedman, A.M. (Argonne National Lab., IL). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The results of a study of neptunium radiolysis in distilled water and seawater is presented in this appendix. Experiments were initially performed with neptunium in the (IV), (V), and (VI) valence states. One of the most significant findings of these experiments is the existence of Np(V) as the stable oxidation state. Np(V) exists in aqueous solution as the monovalent dioxocation NpO_2^+. Being a monovalent ion it does not interact as strongly with the surrounding medium as higher charged ions and so has greater mobility. Most of the neptunium tested was soluble in distilled water. The existence of NpO_2^+ as the stable oxidation state implies that barriers around the emplacement site must be designed specifically to retain this potentially highly mobile species.

31731 (SAND—81-1095-Vol.2, pp 267-303) **Study of the mobility of plutonium and americium in marine sediments.** Schreiner, F.; Fried, S.; Friedman, A. (Argonne National Lab., IL). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

A method is described for measuring the diffusion of transuranium elements in samples of sediment from various locations. The purpose of these measurements is the determination of effective diffusion coefficients of the radionuclides in the absence of interstitial flow through the sediment and at ambient temperature and pressure. The concentration profile of tracer amounts of radionuclides can be measured in cylindrical samples of sediment. Limiting values have been determined for plutonium and americium in both the tetravalent and hexavalent state. (DMC)

31732 (SAND—81-1095-Vol.2, pp 305-321) **Radionuclide sorption and diffusion studies.** Erickson, K.L. (Sandia National Labs., Albuquerque, NM). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

Experimental and theoretical analyses of radionuclide sorption by and diffusion in abyssal red clays are being conducted in support of activity C-2, Far-Field Ion Transport, and more specifically in support of subactivities C.2.1.1, Property Acquisition and Model Development and C.2.1.2, Laboratory and/or Field Verification. During the current reporting period, priority of effort has been given to conducting and interpreting data from one-dimensional diffusion experiments involving smectite-rich sediment and radionuclides such as ^{22}Na, ^{137}Cs, ^{133}Ba, ^{144}Ce, and ^{152}Eu. Most data from the diffusion experiments appear consistent with results predicted using appropriate mathematical models and independently measured sorption equilibrium data. In particular, experiments with ^{22}Na indicated that when small effects due to sorption were accounted for, the diffusion coefficient for sodium in the sediment samples was on the order of 3×10^{-6} cm²/sec (at about 23°C), which appears consistent with previously reported results. Experiments with ^{137}Cs; ^{133}Ba, and ^{152}Eu indicated effective diffusion coefficients of 7×10^{-10}, 8×10^{-11}, and 7×10^{-11} cm²/sec, respectively, for those nuclides in the sediment. Such results are consistent with the effective diffusion coefficients which would be expected from the sorption equilibrium data for those nuclides at the solution-phase concentrations involved. However, some deviations from

expected behavior have been observed and are currently under investigation to determine if such deviations represent significant phenomena or are artifacts of the experimental technique.

31733 (SAND—81-1095-Vol.2, pp 323-424) **Heat transfer studies.** Hickox, C.E. (Sandia National Labs., Albuquerque, NM). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

Activities which have been pursued in the area of heat transfer in the subseabed disposal program are summarized in this appendix. Analytical modeling in support of the ISHTE (in situ heat transfer experiment) was directed toward identifying appropriate locations for the 77 thermal sensors which will be inserted into the sediment. The application of parameter estimation techniques to the ISHTE was studied. The design and construction of a line source thermal conductivity probe was initiated to measure in-situ thermal conductivity of sediment. Temperature histories of the over-core sample were investigated. Modeling of transport processes was performed including: ion migration; thermal transport; seabed sediments; and sediment creep. Transient pressure rise in heated sediment and benthic boundary layers were also studied. (DMC)

31734 (SAND—81-1095-Vol.2, pp 425-617) **Geotechnical aspects of subseabed disposal of high level radioactive wastes.** Silva, A.J.; Jordan, S.A.; Levy, W.P. (Univ. of Rhode Island, Kingston). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The primary focus of the program during 1980 was on experimental studies of geotechnical properties and behavior of deep sea sediments in relation to the subseabed disposal program. The following tasks were performed: sediment characterization; quasi-static stress-strain behavior; creep (long term stress-strain) properties; compressibility studies; permeability studies; in-situ heat transfer experiment (ISHTE); and laboratory hole closure experiment. Data are included for each task performed. (DMC)

31735 (SAND—81-1095-Vol.2, pp 619-781) **Constitutive properties and material model development for marine sediments in support of the subseabed disposal program.** Baladi, G.Y.; Akers, S.A. (US Army Engineer Waterways Experiment Station, Vicksburg, MS). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The purpose of the theoretical investigation was to develop an appropriate elastic-plastic effective-stress constitutive model and the necessary numerical algorithms for seabed sediments for use in computer code simulations of both early-time dynamic penetration of waste canisters and late-time hole closure. The purpose of the experimental program was to provide high-pressure dynamic stress-strain and strength properties for seabed sediments of interest, which in conjunction with data provided by the University of Rhode Island (URI), could be used to guide the development and verification of a constitutive model for such materials. The results of the theoretical program are documented in Part I of this report, which contains four chapters. The fundamental basis of elastic-plastic constitutive models is presented in Chapter 1. The numerical implementation of the elastic-plastic models is discussed in Chapter 2. The development of the effective-stress constitutive model for seabed sediments is presented in Chapter 3. The behavior of this effective-stress model under hydrostatic and triaxial compression test conditions is illustrated in Chapter 4. Part II deals with the experimental program and includes five chapters. Chapter 1 deals with background geotechnical information regarding the physical properties of seabed sediments and presents the scope of the experimental program. Testing equipment and specimen preparation are described in Chapter 2. Chapter 3 outlines test procedures and techniques. Test results are presented in Chapter 4. Representative constitutive properties for Pacific illite are given in Chapter 5. Comparison of the final effective-stress constitutive model fits with laboratory test data are presented in Part III. The numerical values of the material model constants for Pacific illite are also summarized therein. Part IV contains a summary and recommendations for future work.

31736 (SAND—81-1095-Vol.2, pp 815-839) **Annual report on the high temperature triaxial compression device.** Williams, N.D.; Menk, P.; Tully, R.; Houston, W.N. (Univ. of California, Berkeley). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The investigation of the environmental effects on the mechanical and engineering properties of deep-sea sediments was initiated on June 15, 1980. The task is divided into three categories. First, the design and fabrication of a High Temperature Triaxial Compression Device (HITT). Second, an investigation of the mechanical and engineering properties of the deep-sea sediments at temperatures ranging from 277 to 473 degrees kelvin. Third, assist in the development of constitutive relationships and an analytical model which describe the temperature dependent creep deformations of the deep-sea sediments. The environmental conditions under which the soil specimens are to be tested are variations in temperature from 277 to 473 degrees kelvin. The corresponding water pressure will vary up to about 2.75 MPa as required to prevent boiling of the water and assure saturation of the test specimens. Two groups of tests are to be performed. First, triaxial compression tests during which strength measurements and constant head permeability determinations shall be made. Second, constant stress creep tests, during which axial and lateral strains shall be measured. In addition to the aforementioned variables, data shall also be acquired to incorporate the effects of consolidation history, strain rate, and heating rate. The bulk of the triaxial tests are to be performed undrained. The strength measurement tests are to be constant-rate-of-strain and the creep tests are to be constant-stress tests. The study of the mechanical properties of the deep-sea sediments as a function of temperature is an integrated program.

31737 (SAND—81-1095-Vol.2, pp 841-852) **Physical simulations using centrifuge techniques.** Sutherland, H.J. Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

Centrifuge techniques offer a method for doing physical simulations of the long-term mechanical response of deep ocean sediment to the emplacement of waste canisters and to the temperature gradients generated by them. Theoretical investigations of the scaling laws for pertinent phenomena indicate that the time scaling will be consistent among them and equal to the scaling factor squared. This result implies that this technique will permit accelerated-life-testing or proposed configurations; i.e., long-term studies may be done in relatively short times. Medium-scale simulation experiments that are designed to investigate the mechanical response of the sediment are currently in progress. Large-scale simulations can be started in the near future with the completion of the modifications to the Sandia-25 centrifuge.

31738 (SAND—81-1095-Vol.2, pp 853-896) **In-situ heat transfer experiment.** Olson, L.O.; Ewart, T.E. (Univ. of Washington, Seattle). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

Systems are being developed to measure the in-situ thermal conductivity of deep ocean sediment. The initial experiment plan was to implant a 400 watt isotope heat source into the sediment at MPG-I and monitor the thermal field around it at distances of up to 2 m for one year. The temperature data were to be recorded on a seabed platform along with photographs and vane shear values. Upon command, digital data in storage would be sent to the surface acoustically. At the end of the year, corers would be driven in by the platform to take samples of heat affected sediment. These were to be recovered along with the platform for laboratory analysis. Work was progressing well on the design of the various systems until mid-1980 when higher sediment shear strengths were estimated for in-situ MPG-I and more experiments for the platform were added. This report covers the major work performed by APL during 1980 for the ISHTE. The expanded scope of ISHTE has not

affected the work performed on the designs discussed. Design of the platform and the control system will be affected the most; they have been delayed until next year, when more details on the add-on experiments will be available. The locational accuracy of the thermal probes and the predicted higher sediment shear strength have affected the development of the probes and their implantment mechanisms. This has prolonged the completion of their manufacture. The two major systems developed this year for ISHTE have been the acoustic tracking and data telemetry system and the hydrostatic sediment corer. Both systems are highly successful and are described in detail in this report. Another addition to the ISHTE program this year is an ISHTE simulation (ISIMU) to be performed in the Ocean Environment Chamber at NSRDC in Annapolis, Maryland, during October and November 1981. The purpose of this test is to look for unexpected phenomena in the heat affected sediment.

31739 (SAND—81-1095-Vol.2, pp 897-904) **Design and development of deep-water piezometer for the Sandia Subseabed Disposal Program.** Bennett, R.H.; Burns, J.T.; Lambert, D.N. (Atlantic Oceanographic and Meteorological Labs., Miami, FL). Jul 1981. NTIS, PC A99/MF A01.

In Subseabed disposal program annual report, January-December 1980. Volume II. Appendices (principal investigator progress reports). Part 1.

The National Oceanic and Atmospheric Administration (NOAA), Atlantic Oceanographic and Meteorological Laboratories (AOML), Marine Geology and Geophysics Laboratory (MGGL) contracted with Sandia Laboratories, Subseabed Disposal Program (SDP) to prepare initial design and to begin development of a piezometer for the In Situ Heat Transfer Experiment (ISHTE). General design specifications and material types were established by mutual agreement between AOML and Sandia during planning meetings. ISHTE experimental objectives were considered of paramount importance in arriving at the piezometer specifications and on the types of materials to be used. AOML's objectives for the design and development of the piezometer in 1980 included: (1) preliminary design of the mechanical components of the piezometer probe, (2) purchasing of basic materials for fabrication of the initial probe, (3) purchasing of a few selected pressure sensors for high-pressure testing, (4) installation of a high-pressure test facility at AOML for testing pressure sensors, and (5) initiating preliminary testing of pressure sensors. Each of the objectives (1 to 5) were completed successfully in 1980. In addition, AOML constructed a prototype piezometer probe which was tested for mechanical performance in situ in submarine sediments on the US Atlantic continental slope aboard the DSRV ALVIN in October 1980 during NOAA allocated ALVIN time. The mechanical performance test was successful.

31740 (UCRL—53133) **Analysis of the mine-by experiment, climax granite, Nevada test site.** Heuze, F.E.; Butkovich, T.R.; Peterson, J.C. (Lawrence Livermore National Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 53p. NTIS, PC A04/MF A01. Order Number DE81028902.

The Lawrence Livermore National Laboratory (LLNL) is conducting a generic test of retrievable geologic storage of nuclear spent fuel assemblies, in an underground chamber, at the Nevada Test Site, Nye County, Nevada. This generic test is located 420 m below the surface, in the Climax granitic stock. Eleven canisters of spent fuel approximately 2.5 years out of reactor core (about 1.6 kW/canister thermal output) are now emplaced in a storage drift, along with 6 electrical heaters which simulate fuel canisters. Two adjacent drifts contain other electrical heaters, which will be operated to simulate the thermal field of a large repository. An analysis of the mine-by at SFT-C was performed by means of refined finite element models using the JPLAXD code (Jointed, PLane and AXisymmetric, Dilatant). The input for the new models was derived from our field program, which is reported separately. Stress results obtained by modeling methods are compared. All models show that, during mining of the center drift, all caverns close vertically, and the center drift closes horizontally. The walls of the two heater drifts move toward the center drift, with a slight opening or a slight closing of the heater drifts, depending upon the geology. All calculations show both pillars expanding laterally during mine-by. The field-reported lateral contraction of the pillars leads to the very suspicious conclusion that the pillars end up in a state of tension. The field-reported values from horizontal MPEs and horizontal tapes appear to be inconsistent with each other. (DMC)

31741 (UCRL—86043) **Near-field heat transfer at the spent fuel test-climax: a comparison of measurements and calculations.** Patrick, W.C.; Montan, D.N.; Ballou, L.B. (Lawrence Livermore National Lab., CA (USA)). 21 Aug 1981. Contract W-7405-ENG-48. 20p. (CONF-810861—1). NTIS, PC A02/MF A01. Order Number DE81028161.

From OECD Nuclear Energy Agency workshop on near-field phenomena in geologic respositories for radioactive waste; Seattle, WA, USA (31 Aug 1981).

The Spent Fuel Test in the Climax granitic stock at the DOE Nevada Test Site is a test of the feasibility of storage and retrieval of spent nuclear reactor fuel in a deep geologic environment. Eleven spent fuel elements, together with six thermally identical electrical resistance heaters and 20 peripheral guard heaters, are emplaced 420 m below surface in a three-drift test array. This array was designed to simulate the near-field effects of thousands of canisters of nuclear waste and to evaluate the effects of heat alone, and heat plus ionizing radiation on the rock. Thermal calculations and measurements are conducted to determine thermal transport from the spent fuel and electrical resistance heaters. Calculations associated with the as-built Spent Fuel Test geometry and thermal source histories are presented and compared with thermocouple measurements made throughout the test array. Comparisons in space begin at the spent fuel canister and include the first few metres outside the test array. Comparisons in time begin at emplacement and progress through the first year of thermal loading in this multi-year test.

31742 (USGS-OFR—81-57) **Water-level data for wells in burial ground 6, Oak Ridge National Laboratory, Tennessee, 1975 to 1979.** Webster, D.A.; Beatty, J.S.; Benjamin, P.M.; Tranum, W.M. (Geological Survey, Knoxville, TN (USA)). Aug 1980. 120p. NTIS, PC A06/MF A01. Order Number DE81026216.

This report presents data pertaining to wells in Burial Ground 6 at Oak Ridge National Laboratory, Tennessee, for the period 1975 to 1979. It includes an inventory of wells, measurements of water levels, well hydrographs, and a map showing the location of the wells.

31743 **Low-level radioactive waste management in the US: a proving ground.** Levin, G.B. (EG & G Idaho, Inc., Idaho Falls). *Nuclear News (La Grange Park, Illinois)* ; **24**: No. 10, 72-76(Aug 1981).

This paper presents an overview of the current status of low-level radioactive waste (LLW) management in the USA. Low-level wastes are defined as all wastes containing less than 10 n Ci/g (370 Bq/g) transuranic nuclides and that are not mine or mill tailings. There are currently 3 operating commercial LLW disposal sites in the USA. It is estimated that 6 disposal sites are needed for adequate disposal capacity for the country. Costs for disposal and transport are discussed. Technology advancements in volume reduction are described. The need for a sensible system of regulations is also expanded upon. The roles of the NRC and DOE in this area are presented. The author predicts that the LLW management situation will be sensibly resolved and functional within 2 years and a new disposal site will be in operation within 5 years. (DMC)

31744 **Metallurgical aspects of waste metal decontamination by melt refining.** Heshmatpour, B.; Copeland, G.L. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Nuclear and Chemical Waste Management* ; **2**: No. 1, 25-31(1981).

Melt refining has been suggested for decontamination and volume reduction of metallic wastes. Knowledge of metallurgical aspects of the process is essential for effective treatment of various metals. Samples of several metals were contaminated and melted with various fluxes. The resulting ingots as well as the slags were analyzed for their nuclide contents. Compatibility of slags and the refractories was also investigated. Resistance furnace melting was a better melting technique for nonferrous scrap, while induction melting was more suitable for ferrous metals. The extent of decontamination was not very sensitive to slag type and composition. Howev-

er, borosilicate and basic oxidizing slags were more effective on ferrous metals and Cu; $NaNO_3$-NaCl-NaOH fluxes were desirable for Zn, Pb, and Sn; and fluoride slags were effective for Al. Recrystallized alumina was the most compatible refractory for melt refining of both ferrous and nonferrous metals. Melt refining was shown to be an effective method for volume reduction and decontamination of contaminated metal scrap.

31745 **Granulation of slags and metals after melt refining of contaminated metallic wastes.** Heshmatpour, B.; Copeland, G.L.; Heestand, R.L. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Nuclear and Chemical Waste Management ;* 2: No. 1, 33-37(1981).

Melting under an oxidizing slag is an attractive method of decontaminating and reducing the volume of radioactively contaminated metal scrap. The contaminants are concentrated in a relatively small volume of slag, which leaves the metal essentially clean. A potential method of permanent disposal of the resulting slags (and metals if necessary) is to emplace them into deep shale by grout hydrofracture. Suspension of the slag and metal in grout mixtures requires that they be granular. The feasibility of size-reducing the slags and disintegrating the metals and subsequently incorporating them into grout mixtures was demonstrated. Various types of slags were crushed into particles smaller than 3 mm. We also melted several metals and water blasted them into coarse powders ranging in size from 0.05 to 3 mm. We found the crushed slags and the coarse metal powders to be suspendable in grout fluids, which indicates that they are probably disposable by shale hydrofracture. 4 figures.

31746 **Biological reduction of nitrates in wastewaters from nuclear processing using a fluidized-bed bioreactor.** Pitt, W.W.; Hancher, C.W.; Patton, B.D. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Nuclear and Chemical Waste Management ;* 2: No. 1, 57-70(1981).

There are a number of nitrate-containing wastewater sources, as concentrated as 30 wt.% NO_3^- and as large as 2000 m^3/day, in the nuclear fuel cycle. The biological reduction of nitrate in wastewater to gaseous nitrogen, accompanied by the oxidation of a nutrient carbon source to gaseous carbon dioxide, is an ecologically sound and cost-effective method of treating wastewaters containing nitrates. These nitrate-containing wastewater sources can be successfully biologically denitrified to meet discharge standards in the range of 10 to 20 $gN(NO_3^-)/m^3$ by the use of a fluidized-bed bioreactor. The denitrification bacteria are a mixed culture derived from garden soil; the major strain is Pseudomonas. In the fluidized-bed bioreactor the bacteria are allowed to attach to 0.25- to 0.50-mm-diam coal fluidization particles, which are then fluidized by the upward flow of influent wastewater. Maintaining the bacteria-to-coal weight ratio at approximately 1:10 results in a bioreactor bacteria loading of greater than 20,000 g/m^3. This paper describes the results of a biodenitrification R & D program based on the use of fluidized bioreactors capable of operating at nitrate levels up to 7000 g/m^3 and achieving denitrification rates as high as 80 g $N(NO_3^-)$ per day per liter of empty bioreactor volume. 4 figures, 7 tables.

31747 **(ORNL-tr—4770) Storage and solidification of MAW/LAW in underground cavities (Phase 2): three-dimensional heat transport analysis.** Dorst, H.; Schindler, C.; Schoenfeld, R. (Oak Ridge National Lab., TN (USA)). 31 Jul 1980. Translation source information not available . 55p. NTIS, PC A04/MF A01. Order Number DE81029723.

The effect of the three-dimensionality of heat transport on the one hand and the effect of the charging strategy on the temperature distribution in the cavern and in the ambient salt on the other hand were studied. The main objectives in this process were to determine the maximum product temperature and the surface temperatures in order to be able to make a statement concerning results obtained with respect to material transport in the cavern atmosphere due to the convection which develops. In addition, initial rough values were obtained for the order of magnitude of the maximum temperature gradients in the salt. The essential results can be summarized as follows: (1) surface temperature differences which develop and which can be regarded as one of the driving thermodynamic forces for the formation of the convection processes are so small that the convection processes will only be very slight; (2) maximum product temperature when the cavern is continuously filled is to be expected to be approximately 55 to 60°C and thus lies significantly below the previously indicated values; (3) temperature distribution in the area of the uppermost product layers (recently stored) is independent of the stored volume above a certain boundary value; (4) for the temperature gradient from the salt in the immediate vicinity of the product, the order of magnitude is expected to be in time approximately 0.1 °C/hr.

31748 **(ORNL-tr—4773) Storage and solidification of MAW/LAW in underground caverns. Discussion report: June 24-25, 1980.** Kraemer, R. (Oak Ridge National Lab., TN (USA)). 24 Jun 1980. Translation source information not available . 30p. NTIS, PC A03/MF A01. Order Number DE81029722.

This is a report of the workshop on storage and solidification of intermediate-level and low-level radioactive wastes. The following areas were covered: materials investigations which involved reference recipe, pellet production conditions, product examinations, field tests, and model caverns; engineering development on underground conveyance, cavern exhaust system and availability analysis; mining and rock mechanics which included cavern production and sealing technique; and technical safety examination.

31749 **(ORNL-tr—4774) Storage and solidification of MAW/LAW in underground caverns. Discussion report: March 12-13, 1980.** Kraemer, R. (Oak Ridge National Lab., TN (USA)). 15 Feb 1980. Translation source information not available . 15p. NTIS, PC A02/MF A01. Order Number DE81029765.

This is a report of the discussion concerning the status and planned work until the middle of 1981 on the storage and solidification of intermediate-level and low-level radioactive wastes in underground caverns. The following areas were covered: materials investigation which involved reference composition of pellets and information concerning production of simulated intermediate-level radioactive wastes; engineering developments which consisted of dosing, mixing, pelletizing, interim storage, above-ground conveyance, and mixer; mining and rock mechanics; and technical safety studies.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 31678, 31700, 31702, 31715, 31753, 32445, 32463, 32539

31750 **(DOE/EIS—0040-D) Storage of foreign spent power-reactor fuel. Draft environmental impact statement.** (Department of Energy, Washington, DC (USA)). Dec 1978. 273p. NTIS, PC E05/MF E05. Order Number DE81029888.

In October 1977, the Department of Energy (DOE) announced a Spent Fuel Storage Policy for nuclear power reactors. Under this policy, as approved by the President, US utilities will be given the opportunity to deliver spent fuel to US government custody in exchange for payment of a fee. The US government will also be prepared to accept a limited amount of spent fuel from foreign sources when such action would contribute to meeting nonproliferation goals. Under the new policy, spent fuel transferred to the US government will be delivered - at user expense - to a US government-approved site. This environmental impact statement is concerned with effects associated with implementing or not implementing the new policy for the foreign fuels. To show the environmental impact of the foreign spent fuel that may be involved under the Spent Fuel Storage Policy, the environmental effects associated with only the foreign fuel that may be accepted by the US government are assessed in this EIS. The impact of the policy for the domestic fuels is reviewed in a separate environmental statement, DOE/EIS-0015-D. Because the details of the implementation of the policy have not yet been developed, the statement is prepared on a generic, rather than a facility-specific, basis.

31751 **(DOE/EIS—0041-D) Charge for spent-fuel storage. Draft environmental impact statement.** (Department of Energy, Washington, DC (USA)). Dec 1978. 131p. NTIS, PC E03/MF E03. Order Number DE81029870.

This document draws from and is a companion to two other environmental impact statements (EIS's), a draft EIS on the Storage of Domestic Fuels together with its Supplement, and a draft EIS on the Storage of Foreign Fuels. Specifically, this document addresses itslf to whether the fee charged for services, of storage and geologic disposal of spent fuels, by its level or its structure would have any effect on the environmental impacts of implementing the spent fuel policy itself. This Draft Environmental Impact Statement-Fee (DEIS/Fee) thus analyzes the fee and various alternatives to determine the interaction between the fee and the degree of participation by domestic utilities and foreign countries in the proposed spent fuel program for implementing the spent fuel policy. It also analyzes the effect, if any, of the fee on the growth of nuclear power.

31752 **(PNL—3927) Effect of organic complexants on the mobility of low-level waste radionuclides in soils: status report.** Swanson, J.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1981. Contract AC06-76RL01830. 33p. NTIS, PC A03/MF A01. Order Number DE81030409.

The effects of some organic complexants on the sorption by soil of some elements typical of those present in low-level wastes are being evaluated and procedures are being developed to efficiently obtain valid sorption data. Data have been obtained with Hanford soil and the elements europium, nickel, cobalt, cesium, and strontium. Complexants studied to date include ethylenediaminetetraacetic acid (EDTA), diethylenetriaminepentaacetic acid (DTPA), and humic acid. The sorption of cesium and strontium has been found to be affected very little by EDTA or DTPA, as expected. However, these complexants have been found to greatly reduce the sorption of europium, nickel, or cobalt by the soil. The Eu/EDTA system was found to be well behaved, and the effect of the complexant on the sorption by soil was quantified. With nickel and cobalt, however, kinetic problems have been encountered, and the effects of complexants on the sorption by soil have not yet been quantified. The problems encountered in the nickel and cobalt systems have further emphasized the need for the development of methods to assure the general validity of the data obtained in the experiments. Series of experimental results that looked very good within themselves were found by additional procedures to be artifacts of the conditions used. One procedure that has been of great value in identifying invalid data is that of contacting the equilibrated solution from a soil contact with a second batch of soil. Unless the sorption coefficient in the second contact is equivalent to that in the first contact, the data are likely invalid. Efforts are continuing to develop procedures that will allow generally valid data to be obtained in an efficient manner and to employ such procedures to obtain data in a variety of systems pertinent to low-level waste disposal.

0540 Health And Safety

REFER ALSO TO CITATION(S) 31709, 31711, 31724, 31765, 32539, 32546

31753 **(DOE/ER—0024) Environment, safety, health at DOE Facilities. Annual report, Fiscal Year 1980.** (USDOE Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, Washington, DC). Jul 1981. 98p. NTIS, PC A05/MF A01. Order Number DE81029467.

The Department of Energy's occupational safety and property protection performance in fiscal year 1980 was excellent in all reported categories with loss rates generally less than one-third of comparable industry figures. The Department of Energy's fiscal year 1980 incidence rate per 200,000 work hours was 1.1 lost workday cases and 18.2 lost workdays compared to 1.1 lost workday cases and 17.2 lost workdays during fiscal year 1979. The recorded occupational illness rate, based on only 70 cases, was 0.05 cases per 200,000 work hours compared to 0.06 cases per 200,000 work hours for fiscal year 1979. Ten fatalities involving Federal or contractor employees occurred in fiscal year 1980 compared to nine for fiscal year 1979. Four of those in fiscal year 1980 resulted from two aircraft accidents. Total reported property loss during fiscal year 1980 was $7.1 million with $3.5 million attributable to earthquake damage sustained by the Lawrence Livermore and Sandia National Laboratories on January 24, 1980. A total of 131 million vehicle miles of official vehicular travel during fiscal year 1980 resulted in 768 accidents and $535,145 in property damages. The 104,986 monitored Department of Energy and Department of Energy contractor employees received a total dose of 9040 REM in calendar year 1979. Both the total dose and the 1748 employees receiving radiation exposures greater than 1 REM in 1979 represent a continuing downward trend from the calendar year 1978 total dose of 9380 REM and the 1826 employees who received radiation exposures greater than 1 REM. The fifty-nine appraisals conducted indicate that generally adequate plans have been developed and effective organizational structures have been established to carry out the Department of Energy's Environmental Protection, Safety, and Health Protection (ES and H) Program.

31754 **(DOE/EV/01826—1) Uranium miner lung cancer study. Progress report, 1 July 1980-1 July 1981.** Saccomanno, G. (Saint Mary's Hospital and Medical Center, Grand Junction, CO (USA)). 21 Aug 1981. Contract AC02-76EV01826. 8p. NTIS, PC A02/MF A01. Order Number DE81030162.

The projects supported during the past year consist of: (a) collection of material from uranium miners known to have cancer of the lung into a tumor registry; (b) collection of interesting cases for second edition of the Manual on Pulmonary Cytology; (c) the regression study has been modified by computerization of re-reads of all cases which showed moderate atypical squamous cell metaplasia or higher since 1968; (d) continuation of sputum collection, and collection of lungs from deceased miners; (e) cooperation with fluorescent bronchoscopy development for localization of carcinoma in situ of the lung; (f) the immunological studies are presently funded by The Abbott Laboratories, but are closely associated with the lung cancer studies. Our findings suggest that patients developing lung cancer concomitantly develop immune suppression; and (g) a small plastic tube has been developed which will aid in the removal of cells from fiberoptic brushings. The plastic mold is presently being developed by Medi-Tech Corporation in Boston and the tube will be available in September 1981. Analysis of the incidence of small cell cancers of the lung over the last 30 years indicates that the incidence has dropped to 22% during 1975-1979 whereas it was 76.5% during the five year span from 1954-1959. General observations indicate that cigarette smoking is the most potent carcinogen, but that tumors are increased in miners who smoke. Moreover, the ultimate incidence of oat cell carcinoma results in earlier death than with other tumor types. The most commonly found tumor in the non-smoking miner is the small cell type.

31755 **(K-BD—1059-Pt.1) Design guidelines for wind-resistant structures.** McDonald, J.R.; Mehta, K.C.; Minor, J.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Texas Tech Univ., Lubbock (USA)). Jun 1975. Contract W-7405-ENG-26. 90p. NTIS, PC A05/MF A01. Order Number DE81028534.

The purpose of this document is to prescribe criteria and to provide guidance for professional personnel who are involved in the design and evaluation of buildings and structures to resist tornadoes and extreme winds at the Oak Ridge, Tennessee, Portsmouth, Ohio, and Paducah, Kentucky, Plant Sites. The scope of the document covers loads due to extreme winds and tornadoes. Other loading conditions such as dead, live, or earthquake loads shall be considered as prescribed by the Union Carbide Corporation. In Section II the method for determining the maximum design windspeed for any specified level of risk is described. The straight wind and tornado parameters are then deduced from the value of maximum design windspeed. The three types of tornado and extreme wind loads (aerodynamic, atmospheric pressure change and missiles) are treated in Sections III, IV, and V, respectively. Appropriate load combinations are defined in Section VI. The final section contains several examples showing how the design guidelines are used to determine appropriate design wind pressures. A description of the computer program used to predict missile accelerations, velocities and trajectories is contained in Appendix A. Additional design examples are provided in Appendix B.

31756 (K-BD—1059-Pt.2) Tornado risks and design windspeeds for the Oak Ridge Plant Site. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Texas Tech Univ., Lubbock (USA)). Aug 1975. Contract W-7405-ENG-26. 43p. NTIS, PC A03/MF A01. Order Number DE81028583.

The effects of tornadoes and other extreme winds should be considered in establishing design criteria for structures to resist wind loads. Design standards that are incorporated in building codes do not normally include the effects of tornadoes in their wind load criteria. Some tornado risk models ignore the presence of nontornadic extreme winds. The purpose of this study is to determine the probability of tornadic and straight winds exceeding a threshold value in the geographical region surrounding the Oak Ridge, Tennessee plant site.

31757 (PNL—3790) Assessment of criticality safety in DOE facilities. Lloyd, R.C.; Clayton, E.D.; Converse, W.E.; Kottwitz, D.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 38p. NTIS, PC A03/MF A01. Order Number DE81029822.

A study was made to assess nuclear criticality safety in DOE Facilities and to assess the effects of various types of possible improvements. The accident statistics in DOE operations show that the fatalities caused by Nuclear Criticality accidents are small compared to other accident categories. The data show the safety performance after 1965, compared to prior years, was considerably improved indicating that overall safety programs have been effective. Data on criticality safety violations were collected from eight major facilities. These data were categorized by severity indexes and causes were assigned. A total of 421 violations were used in the data base for analysis in a fault tree model. Calculations were made using the fault tree methodology to show expected improvement in safety (reduction in probability of a criticality accident) for a fixed reduction in the number of criticality violations. Based on this analysis, about equal emphasis should be placed on reducing mechanical failures and operator errors as efforts in these two areas will likely produce the most significant improvements in safety. A criticality safety infraction form was prepared to facilitate uniformity in recording data on infractions for subsequent analysis. Discussions with Nuclear Safety Specialists working in the field instilled confidence that criticality safety is being handled by concerned, capable, and knowledgable persons.

31758 (PNL-SA—8881) Comparison of potential radiological consequences from a spent-fuel repository versus natural-uranium deposits. Cloninger, M.O.; Wick, O.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1980. Contract AC06-76RL01830. 15p. (CONF-810217—19). NTIS, PC A02/MF A01. Order Number DE81028232.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

On the basis of the intrinsic properties comparison, the long-term hazard from spent fuel in a geologic repository is comparable to that of a large ore deposit, although the specific nuclide concentration in an individual fuel element is not duplicated in nature. On the basis of the second comparison, a repository constructed within reasonable constraints presents no greater hazard than a large ore deposit. Even without such constraints, however, the natural hazard due to some observed radioactive releases to the biosphere in the United States far exceeds any that could reasonably be expected from a spent-fuel repository. While at first intuition it is reasonable to use natural ore deposits as a basis for criteria for nuclear waste repositories, the variability in the natural system is so great that it does not allow a specific criterion to be stated in absolute terms. It is suggested that if the naturally radioactive environment is to be used as a basis for a criterion regarding repositories, the criterion should be based on the radiological quality of the environment in the immediate region of a specific repository, and should be in terms of an acceptable potential increase in that radiological content due to the existence of the repository. This criterion could then be used as a basis for developing, through experimentation and modeling, specific criteria for a repository system design that is reasonably assured of meeting the environmental criteria.

31759 Potential aerodynamic entrainment of soil from excavation operations in a contaminated area. Sutter, S.L. (Battelle Pacific Northwest Lab., Richland, WA). *Nuclear and Chemical Waste Management ;* **2**: No. 1, 39-42(1981).

Experiments were performed to provide an indication of the amount of material that could be made airborne during soil-working operations in a contaminated area. Contaminated soil was collected, dried, and mixed, and particle size distribution and contamination levels characterized. In a 0.6 x 0.6 m wind tunnel, soil was pumped into an airstream moving at 1.4, 4.6, 6.8, and 8.9 m/s. Airborne mass and particle size samples were collected. The fraction of source soil made airborne increased as a linear function of wind speed. Airborne contamination increased with wind speed at a rate about 4 times the soil mass. Source terms (i.e., fraction of material initially made airborne) can be estimated using the information developed. These can, in turn, be used in diffusion models to estimate downwind contamination levels as required for safety assessments of radioactive or chemical waste sites. 3 figures, 2 tables.

0550 Regulations

REFER ALSO TO CITATION(S) 31683

31760 (AGNS—35900-Conf-137) Integrated near real-time plutonium inventory system for LWR reprocessing solutions. Rebagay, T.V.; Lee, R.S.; Huff, G.A.; Lang, E.J.; Henderson, B.C. (Allied-General Nuclear Services, Barnwell, SC (USA)). Jul 1981. Contract AC09-78ET35900. 23p. (CONF-810847—1). NTIS, PC A02/MF A01. Order Number DE81025445.

From 28. international union of pure and applied chemistry symposium; Vancouver, British Columiba, Canada (Aug 1981).

Nuclear safeguard and nonproliferation concerns have generated worldwide interest on reliable and timely nuclear material control and accountability systems. A system employing on-line total and isotopic plutonium concentration monitors that are compatible with the chemical and radiation environments of an experimental coprocessing system employing a modified Purex process has been developed, fabricated, and demonstrated. In-process plutonium from the first to the final purification cycle has been accurately determined in near-real-time by direct gamma ray spectrometry. Each critical measurement stream was monitored by using a cell that has been carefully calibrated for that stream. The assay of low levels of plutonium (0.1 - 15 g/l) was accomplished by using radiation-resistant and chemically inert plastic cell windows. The more concentrated plutonium solutions were analyzed by interposing appropriate gamma ray adsorbers between the cell and the monitor's detection system. Data acquisition and processing were fully automated and continuous, allowing rapid optimization of the coprocessing flowsheet and timely detection of any attempt to divert the plutonium. The collective outputs of the stream-specific monitors formed on integrated inventory system for the experimental facility.

31761 (CONF-810738—2) Safeguards Analytical Laboratory evaluation program. Part 1. Resin bead mass spectrometry. Part 2. Results of a resin bead field experiment-Tastex. J. Walker, R.L.; Smith, D.H.; Carter, J.A.; Musick, W.R.; Donohue, D.L.; Deron, S.; Asakura, Y.; Kagami, K.; Irinouchi, S.; Masui, J. (Oak Ridge National Lab., TN (USA); International Atomic Energy Agency, Vienna (Austria); Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). 1981. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE81025628.

From 4. SALE program participants meeting; Argonne, IL, USA (Jul 1981).

The first part of this report covers background of resin bead spectrometry and the new batch resin bead method. In the original technique, about ten anion resin beads in the nitrate form were exposed to the diluted sample solution. The solution was adjusted to be a 8 M HNO_3 and to have about 1 μg U per bead. Up to 48 hours of static contact between beads and solution was required for adsorption of 1 to 3 ng Pu and U per bead to be achieved. Under these conditions, contamination was a problem at reprocessing facilities. The new batch techniques reduces the risk of contamination by handling one hundred times more U in the final diluted sample which is exposed to a proportionately larger number of beads.

Moreover, it only requires ten minutes adsorption time to provide about 1000 purified samples for mass spectrometry. The amounts of Pu and U adsorbed versus time were determined and results are tabulated. The second part of this report briefly summarizes results of resin bead field tests completed at the Power Reactor and Nuclear Fuel Development Corporation (PNC) reprocessing plant in Tokai-mura, Japan. Both methods, the original small-sample resin bead and the batch technique, were investigated on spent fuel solutions. Beads were prepared at PNC and distributed to IAEA and ORNL along with dried residues for conventional mass spectrometric analysis at IAEA. Parallel measurements were made at PNC using their normal measuring routines. The U and Pu measurements of all resin and those of PNC are in excellent agreement for the batch method. Discrepancies were noted in the U measurements by the original method.

31762 **(DOE/TIC—11467) Nuclear-waste policies of the new administration.** Meyers, S. (Battelle Memorial Inst., Columbus, OH (USA)). 7 Apr 1981. Contract AC06-76RL01830. 6p. (CONF-8104105—1). NTIS, PC A02/MF A01. Order Number DE81023364.

From Nuclear waste seminar; Baton Rouge, LA, USA (7 Apr 1981).

The highlights of this paper are on the following three areas: the present administration's nuclear waste policies; the Department of Energy's commitment to work with state and local officials in seeking to resolve this national problem; and the state's role. The waste management program has been redirected in two key areas. The first calls for the construction of a test and evaluation facility to demonstrate the capability to package, transport, and dispose of high-level radioactive waste. The second calls for discontinuing plans to store commercial spent fuel at federally owned away-from-reactor facilities. Some of the specifies of this program are: Site investigation activities will focus on three specific locations, which will most likely include the Nevada Test Site and the Hanford site in the state of Washington and the third location in a salt formation to be selected from among those under study. Construction of exploratory shafts at three alternate locations are planned for 1983. Continued national screening of granitic formations in the northeast and other candidates will be continued for the longer-term requirement of a system of regional repositories. The detailed design of the test and evaluation facility are planned to begin in 1985 to allow the beginning of construction of the underground facilities by 1987. Utilities and industry will be allowed to provide necessary facilities and services to manage their spent fuel. The efforts of the utilities to provide additional at-reactor storage represent a safe step in the management of spent fuels. The activities of the Department will be directed toward developing advanced storage technologies, such as dry storage and rod storage (including fuel disassembly).

31763 **(IS-M—336) Application of inductively coupled plasma-atomic emission and fluorescence spectroscopy to the safeguarding of a nuclear facility.** Edelson, M.C.; Fassel, V.A. (Ames Lab., IA (USA)). 1981. Contract W-7405-ENG-82. 16p. (CONF-810706—31). NTIS, PC A02/MF A01. Order Number DE81029818.

From Institute of Nuclear Materials Management conference; San Francisco, CA, USA (13 Jul 1981).

A high resolution spectrometer has been used to resolve the isotopic structure of spectral lines emitted by uranium that has been atomized and excited in an inductively coupled plasma. Multi-isotopic analyses of uranium and spectra of simulated accountability tank solutions are presented. The potential application of inductively coupled plasma-atomic emission spectroscopy to nuclear safeguards analysis is discussed. A brief description of the laser excited atomic fluorescence method is presented.

31764 **(ORNL/SUB—7605/12-2) International safeguards for spent fuel storage.** Kratzer, M.; Wonder, E.; Immerman, W.; Crane, F. (Oak Ridge National Lab., TN (USA); International Energy Associates Ltd., Washington, DC (USA)). Aug 1981. Contract W-7405-ENG-26. 73p. NTIS, PC A04/MF A01. Order Number DE81029896.

This report analyzes the nonproliferation effectiveness and political and economic acceptability of prospective improvements in international safeguard techniques for LWR spent fuel storage. Although the applicability of item accounting considerably eases the safeguarding of stored spent fuel, the problem of verification is potentially serious. A number of simple gamma and neutron nondestructive assay techniques were found to offer considerable improvements, of a qualitative rather than quantitative nature, in verification-related data and information, and possess the major advantage of intruding very little on facility operations. A number of improved seals and monitors appear feasible as well, but improvements in the timeliness of detection will not occur unless the frequency of inspection is increased or a remote monitoring capability is established. Limitations on IAEA Safeguards resources and on the integration of results from material accounting and containment and surveillance remain problems.

31765 **(ORNL-tr—4769) Conditions for release of radwaste and contaminated materials to the central division of decontamination operations (HDB).** Jacob, M. (Oak Ridge National Lab., TN (USA)). Sep 1979. Translation source information not available . 22p. NTIS, PC A02/MF A01. Order Number DE81029766.

The conditions listed in this document are based among others on specifications of final storage, operating, transport and handling licensing as well as the Radiologic Protection Ordinance, regulations for transport of hazardous materials on public arteries and the EURATOM Convention. The purpose of these regulations is: to classify according to release; to clearly describe; and to package and label in a consistent manner radwaste and contaminated materials at the source in order to guarantee safe transport and reliable processing. Radwaste can only be transferred to the Central Division of Decontamination Operations (HDB) under strict observance of these conditions.

06 FUSION FUELS

0601 Sources

REFER ALSO TO CITATION(S) 32303

0602 Processing

31766 **(UCRL—15360) Investigation of methods for fabricating, characterizing, and transporting cryogenic inertial-confinement-fusion tartets.** Fanning, J.J.; Kim, K. (California Univ., Berkeley (USA); Illinois Univ., Urbana (USA). Dept. of Electrical Engineering). Jan 1981. Contract W-7405-ENG-48. 94p. NTIS, PC A05/MF A01. Order Number DE81029737.

The objective of this work is to investigate methods for fabricating, characterizing and transporting cryogenic inertial confinement fusion targets on a continuous basis. A microprocessor-based data acquisition system has been built that converts a complete target image to digital data, which are then analyzed by automated software procedures. The low temperatures required to freeze the hydrogen isotopes contained in a target is provided by a cryogenic cold chamber capable of attaining 15 K. A new method for target manipulation and positioning is studied that employs molecular gas beams to levitate a target and an electrostatic quadrupole structure to provide for its lateral containment. Since the electrostatic target-positioning scheme requires that the targets be charged, preliminary investigation has been carried out for a target-charging mechanism based on ion-bombardment.

0607 Waste Management

31767 **(PNL—3725) Survey of tritium wastes and effluents in near-term fusion-research facilities.** Bickford, W.E.; Dingee, D.A.; Willingham, C.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 84p. NTIS, PC A05/MF A01. Order Number DE81029613.

The use of tritium control technology in near-term research facilities has been studied for both the magnetic and inertial confinement fusion programs. This study focused on routine generation of tritium wastes and effluents, with little referene to accidents or

facility decommissioning. This report serves as an independent review of the effectiveness of planned control technology and radiological hazards associated with operation. The facilities examined for the magnetic fusion program included Fusion Materials Irradiation Testing Facility (FMIT), Tritium Systems Test Assembly (TSTA), and Tokamak Fusion Test Reactor (TFTR) in the magnetic fusion program, while NOVA and Antares facilities were examined for the inertial confinement program.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 32303

0703 Isotopic Power Supplies

31768 **(PNL—1845-50) Quarterly report on the strontium heat source development program, Space and Terrestrial Systems Division for January-March 1981.** Fullam, H.T. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 13p. NTIS, PC A02/MF A01. Order Number DE81028404.

At Hanford, strontium is separated from the high-level waste, converted to the fluo-ride, and doubly encapsulated in small, high-integrity containers for subsequent long-term storage. The fluoride conversion, encapsulation, and storage takes place in the Waste Encapsulation and Storage Facilities (WESF). The encapsulated strontium fluoride represents an economical source of ^{90}Sr if the WESF capsule can be licensed for heat-source applications under anticipated-use conditions. The objects of this program are to obtain the data needed to license $^{90}SrF_2$ heat sources and specifically the WESF $^{90}SrF_2$ capsules. The information needed for licensing can be divided into three general task areas: Task 1--Chemical and Physical Properties of $^{90}SrF_2$; Task 2--$^{90}SrF_2$ Compatibility Studies; and Task 3--Capsule Qualification and Licening. Efforts are proceeding concurrently on all three tasks to obtain the required information.

31769 **(PNL—1845-51) Quarterly report on the Strontium Heat Source Development Program, Operations and By-Products Utilization Division for April-June 1981.** Fullam, H.T. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1981. Contract AC06-76RL01830. 14p. NTIS, PC A02/MF A01. Order Number DE81029617.

All experimental activities related to the Strontium Heat Source Development Program have been completed. The only remaining activities are preparation and issuance of final reports that summarize program results. This report represents the last of the program quarterly progress reports that will be issued.

08 HYDROGEN

REFER ALSO TO CITATION(S) 31801

0801 Production

REFER ALSO TO CITATION(S) 32122, 32147

31770 **(BNL—29461) Development of a metal hydride process for hydrogen recovery from supplemented natural gas.** Reidinger, F.; Hill, F.B. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 6p. (CONF-811007—4). NTIS, PC A02/MF A01. Order Number DE81022685.

From 2. world congress of chemical engineering; Montreal, Canada (4 Oct 1981).

This paper describes some development work on a hydrogen recovery process based on the use of metal hydrides. The results reported here indicate that with respect to mercaptan-alloy interactions a metal hydride hydrogen recovery process may be devised which has commercially attainable pretreatment requirements, a thermal reactivation procedure with temperatures not exceeding 500°C with reactivation required at intervals of 100 absorption-desorption cycles, and an alloy lifetime of the order of 7×10^4 cycles. The interaction of CO_2 with the alloy in the presence of hydrogen appears quite complicated. The present work indicates that CO_2 concentrations up to 500 ppM may have negligible effect on the rate of hydrogen absorption after an initial exposure to CO_2 and hydrogen. If a slower hydrogen sorption rate can be tolerated then higher CO_2 levels may be acceptable. These conclusions may be modified by work yet to be done concerning possible interactions among all model gas components, including hydrogen, and the alloy. Additional aspects of process feasibility to be investigated include absorption-desorption cycle designs and economic evaluation. (DMC)

31771 (DOE/ET/60058—T1, pp vp, Paper 3) **Solar fuels and chemicals.** Reed, J.L. (Atlanta Univ., GA). 1980. NTIS, PC A07/MF A01.

In Cooperative program of applied energy research. Final technical report, October 1, 1979-December 31, 1980.

The task concerns itself with the conversion of solar energy by means of thermochemical processes. A computer assisted methodology for the generation of thermochemical cycles has been developed. In addition a five hundred entry data base consisting of stoichiometry, valance and thermodynamic information has been developed. Preliminary examination of a copper-chlorine cycle has begun. The cycle looks very promising. The preliminary economic considerations are favorable and there are no environmental problems in evidence. Further development of this cycle is proposed.

0803 Transport

REFER ALSO TO CITATION(S) 31772

0804 Marketing And Economics

REFER ALSO TO CITATION(S) 32153

31772 **(BNL—29520) Systems analysis of hydrogen/natural gas supplementation and separation.** Beller, M.; D'Acierno, J.; Hermelee, A. (Brookhaven National Lab., Upton, NY (USA)). Apr 1981. Contract AC02-76CH00016. 6p. (CONF-811007—5). NTIS, PC A02/MF A01. Order Number DE81021383.

From 2. world congress of chemical engineering; Montreal, Canada (4 Oct 1981).

The methodology for the study involved first selecting a specific site for the study, since using national estimates tends to obscure specific regional issues and problems which are critical to the evaluation of such concepts. After the selection of the site, the evaluation focuses upon specific potential markets for hydrogen, and then examines the mix of customers comprising these markets. This establishes the incentives and barriers in the market sphere. Finally, the pipeline infrastructure, its capability for use to store and transmit hydrogen, and the incentives and drawbacks in this area are studied. Preliminary specific conclusions that can be made are as follows: the regulatory problems are certainly not insoluble. If hydrogen, for fuel or non-fuel use or both, is eventually shown to be competitive or desirable by using the natural gas system, as opposed to a separate system, the incentives will lead to regulatory changes. There is sufficient use of both hydrogen and natural gas in potential hydrogen-consuming industries to overcome the problem of reinjection of natural gas into the pipeline after separation. Certainly, this is a non-problem if fuel cells penetrate the electrical utility market in situations where the utility provides both electric and gas service. However, this problem requires further study. The pipeline flexibility problem must be studied for each region of interest to determine the optimality for combined use. This will then lead to rate structure determinations. The economics of using natural gas pipelines with separation must be examined against those of dedicated new hydrogen lines, as well as other terminal onsite hydrogen production options. The overall system economics can be performed parametrically, regardless of the hydrogen sources.

31773 **Hydrogen energy system: energy infrastructure of the future.** Veziroglu, T.N. (Univ. of Miami, Coral Gables, FL). pp 25-34 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The problems caused by the energy crisis and our dependence on fossil fuels are discussed. The use of hydrogen as a solution to the energy problem is addressed. The advantages of using hydrogen as a fuel are presented. Studies have shown that converting to a hydrogen energy system would decrease pollution by 80% and the quality of life would increase 10 fold by the beginning of the next century.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 31771, 31818, 32410

31774 **(AD-A—092738) Multiple ignition, normal and catalytic combustion and quenching of fuel/air mixtures. Annual report.** Burns, C.; Bracco, F.V.; Homan, H.S.; Sirignano, W.A. (Princeton Univ., NJ (USA). Guggenheim Labs. for the Aerospace Propulsion Sciences). 10 May 1980. 61p. NTIS, PC A04/MF A01.

Lean combustion of propane in platinum/alumina/cordierite catalysts has been studied at atmospheric pressure, gas velocities of 10-40 m/s, C3H8 equivalence ratios of .19 to .32 and H2O concentration of 1.2 to 1.7 mol %. Measurements of substrate temperature and gas composition, pressure, and temperature inside and downstream of the catalyst have been made. The dependences of substrate temperature, gas temperature, and gas composition of inlet temperature, reference velocity, and equivalence ratio have been investigated. A two-dimensional model of the gas-phase including the effect of finite-rate chemical kinetics at the substrate surface has been developed and tested. When the experimental wall temperature is used as boundary condition for the gas-phase equations, the emission predictions are in reasonably good agreement with the measured ones. The indications obtained from the model are that propane is oxidized via a multi-step kinetic mechanism, that in the range of temperatures and equivalence ratios explored, most of the fuel is burnt at the catalytic wall rather than in the gas phase, and that wall kinetics is slower than gas diffusion transport.

31775 **(ANL/CNSV-TM—73) Development of a case study for the Cinnaminson landfill methane recovery operation.** Schirra, G.W.; Sharp, T.E.; Nielson, D.C. (Argonne National Lab., IL (USA)). Feb 1981. Contract W-31-109-ENG-38. 67p. NTIS, PC A04/MF A01. Order Number DE81029988.

The development, construction, and operation of a methane recovery plant in Cinnaminson, New Jersey, on the site of a sanitary landfill are described in this report. The project was undertaken in 2 phases. At the end of the 1st phase, 250,000 ft^3/day of gas (heating value of 600 Btu/ft^3) was being produced by the facility and consumed by a nearby industry. At the end of phase II, 600,000 ft^3/day was being produced (heating value of 561 Btu/ft^3). (DMC)

31776 **(DOE/CS/20300—2) Operational characteristics of anaerobic digesters at selected wastewater-treatment facilities in the United States.** (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC01-76CS20300. 46p. NTIS, PC A03/MF A01. Order Number DE81030144.

Bench-scale and pilot plant studies at Pacific Northwest Laboratory have shown that powdered activated carbon is effective in improving volatile solids destruction and gas production in anaerobic digesters that are operating at less than normally expected levels of efficiency. To evaluate the applicability of this technology to digesters in the United States, digester operating characteristics at 60 facilities were surveyed and the number of stressed digesters estimated. The results show that although median values of the operating parameters conformed with those of a well-operated digester, 30% of the digesters surveyed were stressed with regard to at least one important parameter. Of the 30 largest treatment plants in the US, seven fell into this category. Digester gas production and usage were then examined to determine the importance of methane off-gas as an energy source. A conservative estimate is that the gas produced nationally represents a heating value of about 2.36×10^{13} Btu/year with a present value of $40 million. Of this amount, an estimated 75% is used either onsite or sold. Onsite uses include heating digesters and buildings, incinerating sludge, operating equipment, and generating electricity. The other 25% is flared and the energy value lost. The present value of the flared gas is about $10 million/year. Natural gas prices are projected to increase 150% over the next seven years. If the present utilization ratio continues, the flared gas will be worth approximately $27 million in 1985. Presently, digester gas is mainly used for process heating and operating equipment. The technical and economic feasibility of recovering digester gas for electrical power generation, onsite equipment operation, and sales to other consumers (utilities, private companies) should be thoroughly investigated.

31777 **(DOE/CS/20300—3) Production and utilization of methane from anaerobic sludge digestion in US wastewater-treatment plants.** (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC01-76CS20300. 109p. NTIS, PC A06/MF A01. Order Number DE81029958.

The goals of this study were: (1) to estimate the energy potential from the anaerobic digestion of municipal sewage sludge, and (2) to assess present digester gas utilization schemes with respect to energy and cost effectiveness. Present use was determined from limited survey data. To determine the most cost effective use of digester gas, conventional onsite and offsite uses were considered. Three generic onsite uses were selected for energy and cost accounting analysis: heat generation, mechanical energy generation, and electrical energy generation. A sensitivity analysis was also performed to assess the effects of change in the economic analysis variables. Of the gas utilization methods analyzed, the most energy efficient and cost effective was found to be the direct production of mechanical energy to drive aerators and pumps. The mechanical energy generation scheme uses all of the digester gas by burning it directly in internal combustion engines. Between 50 and 80% of the mechanical energy required for wastewater treatment can be provided by digester gas. In addition, waste heat can be recovered from the engines to aid in heating the digesters and buildings. Total energy costs for the mechanical energy generation scheme averaged around $30/million gallons treated, compared to $34/million gallons and $45/million gallons for the electrical energy generation and heat generation schemes, respectively. The mechanical energy generation scheme was therefore found to be both energy efficient and cost effective over the range of treatment plant sizes.

31778 (DOE/ET/60058—T1, pp vp, Paper 1) **Catalytic conversion of biomass to useful fuels.** Polk, M.B.; Taylor, B.; Phingbodhipakkiya, M. (Atlanta Univ., GA). 1980. NTIS, PC A07/MF A01.

In Cooperative program of applied energy research and technology development. Final technical report, October 1, 1979-December 31, 1980.

Twelve catalytic wood pyrolysis experiments were completed. The catalysts studied were copper carbonate on silica, nickel carbonate, potassium carbonate, sodium silicate, silica-alumina and mixtures of silica-alumina/nickel carbonate, and silica-alumina/copper carbonate. The most promising catalyst was silica-alumina/nickel carbonate. As a matter of fact, the system developed leaks as a result of the large volume of gas produced when the catalyst system used was silica-alumina/nickel carbonate.

31779 (DOE/ET/60058—T1, pp vp, Paper 2) **Catalytic conversion of biomass to useful fuels.** Knight, J.A.; Hurst, D.R.; Elston, L.W. (Georgia Inst. of Technology, Atlanta). 1980. NTIS, PC A07/MF A01.

In Cooperative program of applied energy research and technology development. Final technical report, October 1, 1979-December 31, 1980.

The pyrolysis of lignocellulosic waste materials typically yields char, an oil condensate, an aqueous condensate, and noncon-

densible gases. The char and condensed oil are storable and transportable products. The noncondensible gas yield, depending on the process method chosen, has a low to medium higher heating value (5500 to 16,700 kJ/kg) and must be consumed on site for process energy or as a synthesis gas feedstock. The aqueous yield typically contains two to fifteen percent dissolved or entrained organic material. The purpose of this study was to examine the effect in the Georgia Tech 15.2 cm tube furnace apparatus (Appendix A) of catalysts mixed with the feed material on the resulting yield distributions and on the properties of the recovered products. These catalysts should be inexpensive, recoverable, and inoffensive to the environment. The results sought in these experiments were a high yield of noncondensible gas with a high heating value and a ratio approaching two moles of hydrogen per mole of carbon monoxide for potential synthesis applications. It was also desired to reduce the miscibility of the organic and aqueous condensates to enhance the recovery of condensible organics and to minimize the required cleanup of the aqueous condensate. This study includes only catalysts reported to be effective in increasing the overall gas yields. Future proposals are planned for the study of transition metal catalysts and combined catalyst systems.

31780 (DOE/ET/60058—T1, pp vp, Paper 5) **Kinetics of biomass gasification.** Bota, K.B. (Atlanta Univ., GA). 1980. NTIS, PC A07/MF A01.

In Cooperative program of applied energy research and technology development. Final technical report, October 1, 1979-December 31, 1980.

This project involved a study of the kinetics involved in the pyrolysis and gasification of woody matter. The principal product of the pyrolysis of biomass is char which can then be oxidized to synthesis or producer gas.

31781 **(DOE/PC/04717—6) Study of the catalytic conversion of synthesis gas to low-molecular weight hydrocarbons.** Chan, T.Y. (Texas A and M Univ., College Station (USA). Dept. of Chemical Engineering). Aug 1981. Contract AS22-78PC04717. 112p. NTIS, PC A06/MF A01. Order Number DE81028157.

Thesis.

The search for alternative sources of energy has provided the stage for the examination of catalytic reactions which can influence the supply of low molecular weight chemical feedstocks, such as ethylene, propylene, and butadiene. Synthesis gas produced from partial oxidation of coal is considered the basic building block for all alternative chemical feedstock synthesis. However, the classical Fischer-Tropsch synthesis catalysts exhibit poor selectivity toward low molecular weight hydrocarbons. Utilizing non-trival bifunctional catalysts which can catalyze methanol synthesis and methanol decomposition to hydrocarbons, synthesis gas was converted to hydrocarbons with selectivity of 100% for C_1 to C_4 at reaction temperatures of 595 to 731°K and pressures from 27 to 68 atm. Zinc oxide and copper oxide were used to promote the methanol synthesis, and the acidic-ion exchanged form of erionite was used to catalyze the subsequent methanol decomposition to hydrocarbons. Methanol and/or dimethylether which are the precursors for hydrocarbons were found in the reactor exit. The hydrocarbons produced were between C_1 and C_4 which demonstrate the shape selectivity of erionite. The olefinic content of the hydrocarbon produced was small compared to the paraffinic content. Experiments with ethylene and hydrogen indicated that the methanol synthesis component of the hybrid catalyst was highly active toward olefin hydrogenation. Addition of water into the feed of ethylene and hydrogen caused a substantial reduction of ethylene hydrogenation. The water gas shift reaction, catalyzed by methanol synthesis component, was observed to be in dynamic equilibrium. Comparison of the different catalysts showed that erionite impregnated with zinc oxide had the highest selectivity and activity toward paraffins and olefins.

31782 **(MIT-EL—81-005) Model pathways in lignin thermolysis.** Klein, M.T.; Virk, P.S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Feb 1981. Contract AM01-76EI02295. 99p. NTIS, PC A05/MF A01. Order Number DE81029767.

Thesis.

A fundamental description of lignin thermolysis was attempted. Analysis of the chemical topology of lignin suggested likely reaction pathways of import to lignin pyrolysis. In turn, 20 model compound pyrolysis substrates were selected to mimic the important reactive functional groups present in whole-lignin thermolysis. The more salient models were: phenethyl phenyl ether (PPE), which depicts the most prevalent lignin interunit linkage, guaiacol, model of the predominant aromatic methoxyl, and saligenol and cinnamyl alcohol, models of important propanoid side chains. Detailed pathway and kinetic analyses and determination of reaction Arrhenius parameters provided mechanistic insights into the model compound pyrolyses. Several pericyclic reaction mechanisms, hitherto not mentioned in the lignin pyrolysis literature, were suggested. In particular, PPE likely pyrolyses via a concerted retro-ene mechanism, whereas guaiacol and saligenol may respectively eliminate methane and water by concerted group transfers. A statistical interpretation of the lignin substrate coupled with the experimental model compound pyrolyses allowed simulation of whole-lignin thermolysis. The simulations were in substantial agreement with experimental pryolyses reported in the literature in regard to overall gas, methane, carbon monoxide, individual phenols, and carbonaceous residue yields. Weight loss kinetics deduced from the time dependency of the latter yield also accorded well with the experimental literature.

31783 **(PB—81-110504) Evaluation of Fresh Kills landfill gas for industrial applications. Final report, August 1977-March 1980.** Briceland, C.; Bortz, S.; Khinkis, M.J.; Abassi, H.; Waibel, R.T. (Institute of Gas Technology, Chicago, IL (USA)). Mar 1980. 183p. NTIS, PC A09/MF A01.

This report describes a combined laboratory and field test program carried out at the Fresh Kills Landfill on Staten Island to determine the acceptability of landfill gas as a replacement for natural gas and imported fuels in industrial processes. Landfill gas, created by the natural breakdown of organic materials, is about 50 percent methane. The Fresh Kills gas was tested to gauge its performance, characteristics and heat value, especially in relation to natural gas. The result of the tests were so favorable, that an aggressive program has been initiated statewide to identify landfill sites and potential industrial users for the landfill gas.

31784 **(PNL—3951) Transportation fuels from synthetic gas.** Baker, E.G.; Cuello, R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 25p. NTIS, PC A02/MF A01. Order Number DE81029614.

Twenty-five experimental Fischer-Tropsch synthesis runs were made with 14 different catalysts or combinations of catalysts using a Berty reactor system. Two catalysts showed increased selectivity to transportation fuels compared to typical Fischer-Tropsch catalysts. With a catalyst consisting of 5 wt % ruthenium impregnated on a Y zeolite (run # 24), 63 to 70 wt % of the hydrocarbon product was in the gasoline boiling range. Using a 0.5 wt % ruthenium on alumina catalyst (run # 22), 64 to 78 wt % of the hydrocarbon product was in the diesel fuel boiling range. Not enough sample was produced to determine the octane number of the gasoline from run # 24, but it is probably somewhat better than typical Fischer-Tropsch gasoline (~ 50) and less than unleaded gasoline (~ 88). The diesel fuel produced in run # 22 consisted of mostly straight chained paraffins and should be an excellent transportation fuel without further refining. The yield of transportation fuels from biomass via gasification and the Fischer-Tropsch synthesis with the ruthenium catalysts identified in the previous paragraph is somewhat less, on a Btu basis, than methanol (via gasification) and wood oil (PERC and LBL processes) yields from biomass. However, the products of the F-T synthesis are higher quality transportation fuels. The yield of transportation fuels via the F-T synthesis is similar to the yield of gasoline via methanol synthesis and the Mobil MTG process.

31785 **(PNL-SA—9350) Progress on catalyzed steam gasification of biomass.** Mudge, L.K.; Mitchell, D.H.; Weber, S.L.; Sealock, L.J. Jr.; Robertus, R.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 54p. (CONF-810360—4). NTIS, PC A04/MF A01. Order Number DE81028198.

From 12. biomass thermochemical conversion contractors meeting; Washington, DC, USA (18 Mar 1981).

The overall objective of the PNL studies is to evaluate the technical and economic feasibility of producing specific gas products via catalytic gasification of biomass. Specific products that are being studied include (a) methane, (b) synthesis gases for production of ammonia, methanol, and hydrocarbons, (c) hydrogen, and (d) carbon monoxide. In the studies, yields of high-value, gaseous products from a single-reaction stage are enhanced by the proper choice of reactants, operating conditions, and catalyst combinations. Gaseous products, successfully produced by the various steam gasification systems employed to date, include synthesis gases for hydrocarbon, methanol, and ammonia generation and a methane-rich gas. This report details progress of the laboratory studies, process development unit (PDU) studies, and economic analyses conducted at PNL since the eleventh Contractors' Meeting in September 1980. Laboratory studies are presently concentrated on development of regenerable catalyst systems. Conditions for generation of an ammonia synthesis gas and use of alternative feedstocks will also be studied. Operations in the PDU on evaluation of yields with a wood feedstock have been completed at atmospheric pressure. Modifications for operation at 100 psig are underway. Wood and alternative feedstock will be tested in the modified PDU. Evaluation of yields and determination of catalyst durability will be studied. The economics of plants for generation of methane from wood and methanol from wood have been determined. The ASPEN computer code is being developed to use for updating process economics and for evaluating alternative processing schemes.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 31771, 31785, 31809, 31810

31786 **(DOE/AF/92005—T1) Development of a small-scale commercial alcohol dehydration 190 to 200 proof. Final report.** (Agri Stills of America, Springfield, IL). 1981. Contract FG02-81AF92005. 5p. NTIS, PC A02/MF A01. Order Number DE81030158.

The objective of this project is to investigate, research, and develop a small scale farm sized commercial unit to produce anhydrous 200 proof ethanol from 190 proof source of locally produced grain alcohol (ETOH). The site of this research is at the Agri Stills of America experimental grain alcohol plant at 3550 Great Northern Ave., Springfield, Illinois. The approach is to investigate a low pressure process to efficiently separate water from 190 proof alcohol, with and without the use of a third component to break the azeotrope of water and alcohol formed during atmospheric conditions. Results from this experiment show that a vacuum shell is not sufficient in design to effect wet alcohol to the anhydrous state.

31787 **(PB—81-100208) Fuel alcohol: report and analysis of plant conversion potential to fuel alcohol production.** (McKee (Davy) Corp., Cleveland, OH (USA)). Sep 1980. Contract NAFC-T-16076552. 130p. NTIS, PC A07/MF A01.

An analysis is made of the national potential to convert and/or to retrofit existing plants to process their present feedstock into fuel alcohol in lieu of their originally designed final product. Categories of plants examined are distilleries, breweries, corn wet milling, beet and cane sugar mills, wineries, cheese whey, and other food processing. Outline descriptions are developed for a base-case plant in each of the industries found to be a viable contributor to a fuel alcohol program. These base-case plants are illustrative of plant size, estimated capital costs of conversion, operating costs, labor estimates for daily operation, and estimated time schedules for comparison purposes. The facilities described as convertible could begin making alcohol by 1982, with a total of 581 million gallons of ethanol identified by 1985 and an additional 300 million gallons being possible. Thus with current production, these additional volumes can largely meet the President's 1982 ethanol goal, and can contribute greatly to the 1985 goal. A glossary is included.

31788 **(PB—81-105546) The development of waterborne alcohol fuel plants. Volume 1: final report. Report for October 1979-September 1980.** Phillips, S.W.; Weiss, L.H.; Colen, M.C. (International Maritime Associates, Inc., Washington, DC (USA)). Sep 1980. Contract MA79-SAC-00078. 167p. NTIS, PC A08/MF A01.

The charter of the project was to review alcohol production processes and feedstock, study their application to floating plant technology and perform case studies that would show the near term potential for these types of plants. The four case studies dealt with production of methanol from natural gas in Cook Inlet, Alaska; methanol from natural gas in Baltimore Canyon, Atlantic Ocean; ethanol and methanol for codisposed refuse and sludge--long range plan for New York City; ethanol from agricultural feedstocks and MSW, State of Louisiana. Two plants were used in design and economic studies--1000 TDP methanol plant and 250 TPD ethanol plant.

31789 **(PB—81-105553) The development of waterborne alcohol fuel plants. Volume 2: case studies. Final report, October 1979-September 1980.** Phillips, S.W.; Weiss, L.H.; Colen, M.C. (International Maritime Associates, Inc., Washington, DC (USA)). Sep 1980. Contract MA79-SAC-00078. 148p. NTIS, PC A07/MF A01.

The charter of the project was to review alcohol production processes and feedstock, study their application to floating plant technology and perform case studies that would show the near term potential for these types of plants. The four case studies dealt with production of methanol from natural gas in Cook Inlet, Alaska; methanol from natural gas in Baltimore Canyon, Atlantic Ocean; ethanol and methanol from codisposed refuse and sludge--long range plan for New York City; ethanol from agricultural feedstocks and MSW, State of Louisiana. Two plants were used in design and economic studies--1000 TPD methanol plant and 250 TPD ethanol plant.

31790 **(PB—81-105561) The development of waterborne alcohol fuel plants. Volume 3: Summary of findings/presentation. Final report, October 1979-September 1980.** Phillips, S.W.; Weiss, L.H.; Colen, M.C. (International Maritime Associates, Inc., Washington, DC (USA)). Sep 1980. Contract MA79-SAC-00078. 60p. NTIS, PC A04/MF A01.

The charter of the project was to review alcohol production processes and feedback, study their application to floating plant technology and perform case studies that would show the near term potential for these types of plants. The four case studies dealt with production of methanol from natural gas in Cook Inlet, Alaska; methanol from natural gas in Baltimore Canyon, Atlantic Ocean; ethanol and methanol from codisposed refuse and sludge--long range plan for New York City; ethanol from agricultural feedstocks and MSW, State of Louisiana. Two plants were used in design and economic studies--1000 TDP methanol plant and 250 TPD ethanol plant. This document provides highlights of the first two volumes and copies of presentation material.

31791 **(PB—81-109373) Fuel alcohol on the farm: a primer on production and use.** (National Alcohol Fuels Commission, Washington, DC (USA)). 1980. 45p. NTIS, PC A03/MF A01.

The primer outlines for farmers the major factors to be considered before undertaking the production of ethanol on a small-scale basis - feedstocks, financing, safety, vehicle conversion and permit requirements. It illustrates and describes four small-scale stills that are currently operating.

31792 **(PB—81-800096) Alcohol fuels. 1973-July, 1980 (citations from the American Petroleum Institute Data Base). Report for 1973-July 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 266p. NTIS PC N01/MF N01.

Research on alcohol fuels are cited. The citations cover synthesis, chemical analysis, performance testing, processing, pollution, economics, environmental effects, and feasibility. (This updated bibliography contains 260 citations, 82 of which are new entries to the previous edition.)

31793 (SAND—81-1757) Balance laws for deformable continua. Herrmann, W. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 44p. NTIS, PC A03/MF A01. Order Number DE81028999.

Equations governing the motion of deformable media are collected in uniform notation. Heat conduction as well as externally prescribed body forces and heat sources are included, but mutual gravitation and radiation are excluded.

0903 Inorganic Hydrogen Compound Fuels

REFER ALSO TO CITATION(S) 31785

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 31828, 32184, 32191

31794 (ANL/CNSV-TM—80) Vertical combustor for refuse combustion. Chung, P.M. (Argonne National Lab., IL (USA); Illinois Univ., Chicago (USA)). Jun 1981. Contract W-31-109-ENG-38. 64p. NTIS, PC A04/MF A01. Order Number DE81030002.

A vertical combustor for refuse-particle combustion was analyzed for waste-to-energy recovery. A one-dimensional model was constructed that consisted of fuel particles, inert solid particles, and the gaseous mixture. The gaseous mixture was divided further into six chemical species that are involved in combustion at temperatures below about 2000°F. It was concluded that such combustors may be viable in the United States since US refuse contains large amounts of volatile matter. Combustion of the relatively small char, however, may not be cost-effective in the present combustor where the fuel residence time is on the order of 2 s for a combustor height of 20 to 30 ft. A computer solution was designed to optimize a given combustor system. A simplified version of the solution was programmed for a TI-59 programmable hand calculator for field use.

31795 (PB—81-109100) Environmental assessment of a waste-to-energy process: GSA/Pentagon co-fired boiler tests. Final report. Golembiewski, M.A. (Midwest Research Inst., Kansas City, MO (USA)). Oct 1980. Contract EPA-68-02-2166. 58p. NTIS, PC A04/MF A01.

Midwest Research Institute (MRI), in conjuction with the General Services Administration (GSA) and the National Center for Resource Recovery (NCRR), conducted a series of emission tests at the Virginia Heating and Refrigeration Plant (VHRP) in Arlington, Virginia (this plant provides steam heat or refrigerated air to the Pentagon building). The study was designed to obtain emission data while one of the steam boilers was co-fired with different blends of coal and densified refuse-derived fuel (d-RDF).

31796 (PB—81-111106) A field test using coal:DRDF blends in spreader stoker-fired boilers. Final report, June 1976-July 1978. Degler, G.H.; Rigo, H.G.; Riley, B.T. Jr. (Systems Technology Corp., Xenia, OH (USA)). Aug 1980. Contract EPA-68-03-2426. 237p. NTIS, PC A11/MF A01.

This program was conducted to characterize and demonstrate the technical, economic, and environmental feasibility of combustion densified forms of refuse derived fuel (dRDF) blended with coal in spreader stoker-fired boilers. A total of 258.5 Mg (285 tons) of pelletized 1/2-inch-diameter x 3/4-inch-long dRDF was co-fired with coal in 2.7 x 7.5 kg/sec (60,000 lb/hr) and 3.6 x 10 kg/sec (75,000 lb/hr) of 1.03 MPa (150 psig) saturated steam. The results indicate that coal:dRDF blends up to 1:2 can be handled and burned in conventional spreader stoker-fired boilers without major equipment modification. As more dRDF was substituted for coal, the flame volume increased, the opacity decreased, the fly ash carbon burnout improved, and the turndown ratio of boiler operation increased. The emissions from the blend firing decreased slightly in mass flux, dropped significantly in particulate size and stack opacity, and had satisfactory particulate resistivities.

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 31801

1301 Resources And Availability

31797 (CONF-8106137—3) Success story: Department of Energy small hydroelectric loan program. Hymer, A.E.; Magleby, H.L. (Gilbert Associates, Inc., Reading, PA (USA)). 1981. Contract AC07-76ID01570. 11p. NTIS, PC A02/MF A01. Order Number DE81027818.

From WATERPOWER 1981 conference; Washington, DC, USA (22 Jun 1981).

The Public Utilities Regulatory Policy Act of 1978 (Public Law 95-617) authorized the Department of Energy (DOE) to establish a program to provide low interest, forgivable loans to finance feasibility studies and licensing activities for small hydroelectric projects. Final regulations became effective February 19, 1980, and the first loans under the program were granted April 19, 1980. The program is limited to sites with existing dams and was originally limited to sites with capacity of less than 15 MW. The limit on capacity was raised to 30 MW by the Energy Security Act (Public Law 96-294) which became effective in late summer of 1980. As part of the activities to achieve the goals of President Reagan to reduce the federal budget, the funding for the Small Hydroelectric Loan Program is under review. Pending the outcome of the review, the DOE has discontinued offering loan agreements as of February 1981. Prior to the suspension, 150 loan agreements were offered for projects throughout the US, representing a capacity of 540 MW and an annual energy of 2.2 x 10^9 kWh. The 150 loans resulted from an evaluation of approximately 170 proposed projects. The economic benefits contemplated from these projects are discussed in terms of the relative cost of building and operating oil-fueled or nuclear plants for the same total output, the advantage in reducing the outflow of US dollars to purchase foreign oil, and cost of the program to the taxpayer. It is the view of the Administration that the goals of the program have been achieved, that private industry and the States will fund future development, and that the 1982 budget should appropriate no funds for continuing the loan program. (LCL)

1305 Economics And Management

REFER ALSO TO CITATION(S) 32127

1306 Environmental Aspects

31798 (PB—81-104663) Report on assessment of small hydroelectric development at existing facilities. (Water and Power Resources Service, Denver, CO (USA). Engineering and Research Center). Jul 1980. 420p. NTIS, PC A18/MF A01.

This report contains the results of an assessment by the Water and Power Resources Service of opportunities to develop small hydroelectric powerplants at existing Water and Power water resource development projects. As an indication for the need of additional power and energy supplies, the report displays the 10-year forecasts of electrical power and energy demands of the National Electrical Reliability Council. A total of 159 potential small hydroelectric developments were evaluated using an iterative process of analysis and screening. A basic assumption was that existing reservoir operations and existing flow regimes would remain unchanged with development. As a result of the analysis and screening, 46 sites were identified as being economically feasible. Data on possible environmental and social impacts and public acceptability were gathered for these 46 sites. A final evaluation was based on economic, environmental, social, and acceptability factors. Based on the data available, it was concluded that the development of 37 of the 46 selected sites would result in no significant environmental and social impacts and would be acceptable to and supported by the affected publics.

14 SOLAR ENERGY

31799 **(MASEC/R—80-001/R2) Programmatic and financial solar incentives.** Lupoli, J.P. (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). May 1980. 47p. NTIS, PC A03/MF A01. Order Number DE81028427.

The availability of solar grants for various types of users and organizations is reported. This report provides a compendium of facts regarding various program opportunities, outright grants, and the respective contacts for those solar financial opportunities currently available in fiscal year 1980. The twelve Mid-American States (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin) are the primary constituents to which this report is tailored. The seven basic solar technologies briefly discussed are heating, cooling, and hot water; agricultural and industrial process heat; photovoltaics, solar thermal; ocean thermal energy conversion; wind energy; and biomass conversion. The following programs are described; Federal Assistance Programs; Federal Loan Programs; Federal Tax Incentives; Regional Subcontracts Programs; State Incentive Programs, and Local Government Assistance. Private sources of funding are described. (MCW)

31800 **(MASEC/R—81-002/R2) Programmatic and financial solar incentives.** Lupoli, J.P. (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Jul 1981. Contract AC02-79CS30150. 44p. NTIS, PC A03/MF A01. Order Number DE81028978.

The report concerns the availability of solar grants for various types of users and organizations. This report is designed to provide a compendium of facts regarding various program opportunities, outright grants, and the respective contacts for those solar financial opportunities currently available in Fiscal Year 1981. The twelve Mid-American States (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin) are the primary constituents to which this report is tailored. The seven basic solar technologies briefly discussed are heating, cooling, and hot water; agricultural and industrial process heat; photovoltaics; solar thermal; ocean thermal energy conversion; wind energy; and biomass conversion. The following available programs are described: Federal Assistance Programs; Federal Loan Programs; Federal Tax Incentives; Regional Subcontracts Programs; State Incentive Programs; and Local Government Assistance. Private sources of funding are described. (MCW)

31801 **Renewable energy research in India.** Bombay, India; Tata Energy Research Institute (1981). 275p. (NP—190438).

A compendium of progress reports on renewable energy sources research programs in India is presented. Sixty-four contributions from government departments, academic institutions, research institutions, and industries are included. (MCW)

1401 Resources And Availability

31802 **(LBL—12967) Hemispherical sky simulator for daylighting model studies.** Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 6p. (CONF-810925—19). NTIS, PC A02/MF A01. Order Number DE81028130.

From 6. national passive conference; Portland, OR, USA (8 Sep 1981).

The design of a 24-foot-diameter hemispherical sky simulator recently completed at LBL is described. The goal was to produce a facility in which large models could be tested; which was suitable for research, teaching, and design; which could provide a uniform sky, an overcast sky, and several clear-sky luminance distributions, as well as accommodating an artificial sun. Initial operating experience with the facility is described, the sky simulator capabilities are reviewed, and its strengths and weaknesses relative to outdoor modeling tests are discussed.

31803 **(SERI/TP—643-1324) All-sky, video-based luminance mapper for daylighting research.** Cannon, T.W.; Dwyer, L.D. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 5p. (CONF-810925—20). NTIS, PC A02/MF A01. Order Number DE81029276.

From 6. national passive conference; Portland, OR, USA (8 Sep 1981).

A video-based system has been developed at the Solar Energy Research Institute for acquisition and luminance analysis of all-sky and interior-surface images. One of the unique features of the system is use of an orthographic-projection fisheye lens and transfer lens combination to produce an image of the entire sky dome on the camera's vidicon target. Video data for each image is digitized in real time to produce a field of data which is analyzed to produce meaningful measurements. The camera system is described and examples of all-sky luminance mapping as well as application to interior surface mapping of daylighting models are presented.

31804 **(SOLAR/0010—81/07) Environmental data for sites in the National Solar Data Network.** (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). Jul 1981. Contract AC01-79CS30027. 176p. PC A 09/MFA01. Order Number DE81028176.

Environmental information collected at the sites of the National Solar Data Network is tabulated for each solar site. The sites are grouped into 12 zones, each of which consists of several adjacent states. The insolation table presents the total, diffuse, direct, maximum, and extraterrestrial radiation for the solar site. It also shows the ratio of total to extraterrestrial radiation, as a percent. The temperature table gives the average, daytime, nighttime, maximum, minimum and inlet-water temperatures for the solar site. All of the passive and some of the active solar sites are equipped with wind sensors which provide information for two wind tables furnishing wind speed and direction. For some sites, a humidity table provides relative humidity values for day and night. It also gives values for the maximum and minimum humidity for each day. A technical discussion of the instruments and measurements used to obtain these data tables is included. (LEW)

1403 Economics

REFER ALSO TO CITATION(S) 31855, 31857, 31864, 32469

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 31844, 32410

31805 **(CONF-810125—1) Transcript of panel discussion.** (Florida Solar Energy Center, Cape Canaveral (USA)). 1981. Contract FC02-79CS30278. 31p. NTIS, PC A03/MF A01. Order Number DE81029089.

From Solar technology assessment conference; Orlando, FL, USA (29 Jan 1981).

A panel discussion is reported which addresses several questions of solar commercialization and technology readiness. Appropriate and inappropriate roles for the government in commercialization, for instance in funding research and development or certain kinds of advertising, are discussed. The panel members opinions of priorities among different solar technologies are given. Possible roles of the utilities in marketing and distribution of residential photovoltaics are discussed. Panel comments are given on six reasons for not investing in research and development for solar components. Power conditioning and federal involvement in the area of wind generated electricity are addressed. Alternative energy particularly for island markets, especially photovoltaic and OTEC, are discussed. Criticisms of solar repowering are addressed. Some questions on photovoltaics are answered, and the distinction is made between demonstrations and experiments. (LEW)

31806 **(PB—81-127359) Overcoming land use barriers to solar access: solar planning recommendations for local communities. Final report.** Vidich, C. (Central Naugatuck Valley Regional Planning Agency, Waterbury, CT (USA)). Feb 1980. 147p. NTIS, PC A07/MF A01.

This report analyzes the existing legal and institutional barriers to the installation of solar energy systems and to the protection of solar access caused by land use regulations and policies in the Central Naugatuck Valley Region. The report identifies specific barriers in zoning, subdivision, inland wetland, historic district, building code, and public health code regulations which could impede the development of solar domestic hot water systems and passive solar design concepts. Specific recommendations are provided for overcoming land use barriers to solar access and for promoting energy conscious building, landscaping and site planning design in Connecticut.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 31771, 31778, 31779, 31780, 31782, 31784, 31785, 31786, 31787, 31791, 31849, 32450

31807 (AD-A—089216) **Luminescent photoelectrochemical cells. 2. Doped cadmium sulfide photoelectrodes as probes of excited-state processes which influence optical to electrical energy conversion. Technical report.** Karas, B.R.; Ellis, A.B. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 12 Aug 1980. Contract N00014-78-C-0633. 62p. NTIS, PC A04/MF A01.

The use of photoelectrochemical cells (PECs) to mediate the direct conversion of optical energy to electricity is receiving widespread attention. Typical PECs consist of an n-type semiconductor photoanode, a counterelectrode and the electrolyte. The key elements are the semiconductor which functions in the dual roles of photoreceptor and electrode, and the electrolyte which must possess the important features of inhibiting the photocorrosion of the semiconductor. A variety of PECs have now been constructed using these principles and the goal of researchers in the field in generally to optimize the efficiency and longevity of such devices. This report discusses a promising avenue to optimizing efficiency involves characterization of the excited state processes governing the semiconductor electrode. Deactivation of the excited electrode to produce photocurrent and, hence, electricity is only one of several decay paths available.

31808 (AD-A—089217) **Thermal manipulation of deactivation processes in luminescent photoelectrochemical cells employing tellurium-doped cadmium sulfide photoelectrodes. Technical report.** Karas, B.R.; Morano, D.J.; Bilich, D.K.; Ellis, A.B. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 12 Aug 1980. Contract N00014-78-C-0633. 29p. NTIS, PC A03/MF A01.

Temperature significantly modifies the efficiencies of luminescence and photocurrent in an n-type, single crystal, CdS:Te-based photoelectrochemical cell (PEC) employing aqueous polyselenide electrolyte. Between 20 and 100 C photocurrent (quantum yield phi sub x) from ultraband gap 501.7 nm excitation increases modestly by less than or = 20%, whereas photocurrent from bandgap edge 514.5 nm excitation increases by about an order of magnitude, reaching 50-100% of the 20 C 501.7 nm photocurrent. Undoped CdS exhibits a similar photocurrent-temperature profile. Higher temperatures thus extend the wavelength response of CdS- and CdS:Te-based PEC's. In contrast to the increase in photocurrent, emissive efficiency (quantum yield phi sub r) of CdS:Te drops by a factor of approximately 10-20 over the same temperature range; this decline is relatively insensitive to potential and excitation wavelength (501.7 or 514.5 nm).

31809 (ANL/EES-TM—149) **Near-term goals for alcohol fuels from biomass: an overview of resource requirements, land use, environmental, and socioeconomic impacts.** Halsey, J.; Hazard, D.; Kawaoka, K,; Stephens, K.; D'Alessio, G. (Argonne National Lab., IL (USA)). Dec 1980. Contract W-31-109-ENG-38. 111p. NTIS, PC A06/MF A01. Order Number DE81029987.

On January 11, 1980, the President set a target for domestic alcohol fuel production capability of 500 million gallons per year by 1981. Current domestic production capability is about 120 million gallons per year. If the entire amount of 1981 alcohol fuel (all ethanol) was blended to make gasohol, gasohol would account for almost 10 percent of the anticipated 1981 national demand for unleaded gasoline. A 30-percent displacement of gasoline by gasohol before 1986 would require an ethanol production capacity of 3 billion gallons per year, or about 1.2 billion bushels of corn. (About 7.6 billion bushels of corn were produced in the United States in 1979). This report examines the biomass resources needed to meet national alcohol production goals, reviews available technologies for utilizing agricultural products and byproducts, and identifies potential environmental and socioeconomic impacts of near-term alcohol production. The analysis places particular emphasis on near-term (1985 to 1986) land resource requirements and impacts, with particular attention to the major corn producing states. In addition, a number of other studies are discussed that deal with the long-term resource requirements of a National Alcohol Fuels Program. The results of this analysis indicates that: (1) The grain availability for ethanol production does not appear to be limiting for these near-term production capacity goals; (2) Conversely, major expansion of acreage planted in corn should not result from these goals; (3) Environmental impacts on and from farm lands should not increase significantly due to the near-term goals; (4) Food prices may increase in the mid-1980s to late 1980s due to the near-term goals, but farmers should benefit overall; and (5) The expansion of alcohol production in the longer term (1986 to 2000 and beyond) will necessitate the use of additional biomass feedstocks and residues.

31810 (DOE/AF/92016—T1) **Cattail rhizome-derived alcohol interim report.** Gabrielson, J.E. (Gabrielson (James E.), Plymouth, MN (USA)). 30 May 1981. Contract FG02-81AF92016. 22p. NTIS, PC A02/MF A01. Order Number DE81028307.

During the first six months of this project over 600 pounds of rhizomes, weighted wet and dirty were harvested and air dried. Average yields, on low land, were 1.9 tons/acre. Yields from areas in ponds may have been higher but it is difficult to estimate the areas. Sixteen fermentations were made. The results show that the rhizomes do not ferment well unless they are finely ground, and saccharified with acid, malt or enzymes. Grinding and screening so the feed passes a 40 mesh screen and then saccharifying with two enzymes produced the best results. Over 50% of the solids were converted to alcohol and carbon dioxide, 25% yield of alcohol based on dry weight of solids. Based on the maximum land harvest rate and the best alcohol yield production of 285 gallons of alcohol/acre of cattails are projected. This is a very good potential use of what is today marginal land.

31811 (DOE/ER/03162—T1) **Studies of photosynthetic energy conversion.** Clayton, R.K. (Cornell Univ., Ithaca, NY (USA)). Jul 1981. Contract AS02-76ER03162. 20p. (COO—3162-56). NTIS, PC A02/MF A01. Order Number DE81028313.

Spectroscopic studies are reported on the major pigmented components of bacterial photosynthetic membranes: antenna complexes and photochemical reaction centers of Rhodopseudomonas sphaeroides and related species. Through optical studies with polarized light, combining the techniques of linear dichroism and photoselection, the relative orientations have been determined of pigment molecules in reaction centers and antenna complexes and in relation to the photosynthetic membrane. Fairly complete angular coordinates have been obtained of bacterio-chlorophyll (bchl) and bacteriopheophytin in the reaction centers, and less detailed information about antenna pigments (bchl and carotenoids) and bound cytochromes. The result of this kind of work in several laboratories has been a more specific view of the molecular geometry of the reaction center, as related to its photochemical function.

31812 (DOE/ET/20074—T5) **Eucalyptus plantations for energy production in Hawaii. Technical status report, October 1, 1978-October 1979.** (BioEnergy Development Corp., Hilo, HI (USA)). 14 Nov 1979. Contract FC03-78ET20074. 5p. NTIS, PC A02/MF A01. Order Number DE81026400.

The objectives of this project are to investigate a number of options in accomplishing the following: (1) Increase the biomass production of Eucalyptus; (2) Determine the optimum cultural requirements to maximize yield; (3) Assess planting, cultivation, harvesting and transportation equipment requirements, modifying existing equipment if necessary; (4) Determine the optimum mixture of biomass (Eucalyptus and bagasse) at the generator for the produc-

tion of electricity; and (5) evaluate a complete production/conversion system which utilized optimum management conditions in relationship to costs. Sixty-one acres have been cleared and planted. An additional 39 acres will be planted by December 31, 1979 for a total of 100 acres. An additional 51 acres will be cleared for early planting in 1980 with clearing operations continuing presently to enlarge on this figure. Technical work has progressed very well with technical data accumulation now being undertaken by US Forest Service and BDC personnel. Three major tests have been installed in Hilo and Ka'u areas (spacing, nutrient, and species). Land appraisal and management plan has been contracted out to a local, qualified consultant and will be completed and submitted by December 15, 1979. Environmental Assessment Report has been completed and is in final form. It has recently been reviewed by the Community Resource Advisory Committee with favorable comment.

31813 **(DOE/ET/20279—140) Performance of terrestrial photovoltaic modules at MIT Lincoln Laboratory experimental photovoltaic systems.** Forman, S.E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Apr 1981. Contract AC02-76ET20279. 19p. NTIS, PC A02/MF A01. Order Number DE81029995.

During the years 1977-1980, MIT Lincoln Laboratory placed over 11,000 photovoltaic (PV) modules at experimental PV power-generating systems in a number of field test sites in the United States. Prominent among these are a 100-kW system at Natural Bridges National Monument in Utah, a 25-kW system at Mead, Nebraska, and a 15-kW system at Bryan, Ohio. The modules used in each of these systems were procured through the Jet Propulsion Laboratory's Large-Scale Procurement Program. Through a program of periodic surveillance, measurements and inspections at the aforementioned sites, over 250 electrically failed modules have been located, removed and analyzed during this four-year period. The principal causes of failure were: (1) cells cracked due to weathering or internal module stresses; (2) failed solder joints; (3) interconnects not soldered to rear sides of cells at assembly; (4) cells or interconnects electrically shorted to metallic substrates; and (5) broken or split interconnects. Details and photographs of many of the different types of failures are presented. In addition, some of the analysis techniques used to locate the failures are described.

31814 **(DOE/ET/20521—T2) Electrodeposited amorphous silicon for solar applications. Summary report, September 15, 1978-May 31, 1979.** Austin, A.E.; Agrawal, A.K.; Noel, G.T. (Battelle Columbus Labs., OH (USA)). 27 Jun 1979. Contract AC03-78ET20521. 49p. NTIS, PC A03/MF A01.

The work has been on: (1) the development of semiconductor doping of electrodeposited amorphous silicon, and (2) the characterization of physical and electronic properties of the doped silicon. For the doping of electrodeposited silicon, the electrolytic reduction and codeposition of possible n- and p-type dopants was investigated. Three dopants - B, Li, and Ga - were found that could be codeposited with the silicon. Annealing was investigated for activation of these dopants in the silicon. The deposition parameters of temperature and cathode substrates were studied. The hydrogen content of electrodeposited silicon was found to decrease with increasing temperature from about 30 atom percent at 35°C. The deposition onto aluminum substrate was demonstrated in addition to the prior use of titanium substrates. The electronic properties of doped deposits were studied by differential capacitance and Schottky diode measurements. The dopants were found to be activated by annealing in the range of 350 to 400°C. This was also found to be the range for the start of hydrogen release from the silicon. Both n- and p-type doping has been demonstrated.

31815 **(DOE/ET/20605—T2) Preparation of a cost data bank for DOE/Biomass Energy Systems Branch.** Kam, A.Y.; Dickenson, R.L.; Jones, J.L. (SRI International, Menlo Park, CA (USA)). 1979. Contract AT03-76ET20605. 20p. NTIS, PC A02/MF A01. Order Number DE81029379.

This study deals with the preparation of a biomass conversion technology and cost data bank for the Biomass Energy Systems Branch (BES) of DOE/SOLAR. When completed, it may be used with an appropriate methodology to analyze the complex issues of research program planning and analysis. In addition, future market penetration of BES products may be projected, and the options available to the Federal Government to influence the outcome of BES products marketing may also be examined.

31816 **(DOE/ET/23010—T10) Cuprous oxide photovoltaic cells. Final report, 9 April 1979-31 January 1981.** Trivich, D. (Wayne State Univ., Detroit, MI (USA). Dept. of Chemistry). 1981. Contract AC02-79ET23010. 116p. NTIS, PC A06/MF A01. Order Number DE81028927.

Research is described which deals with heterojunctions on Cu_2O, MIS structures, effect of impurities in Cu_2O, new etching procedures, junction formation by reduction of Cu_2O to Cu through hydrogen ion bombardment, theoretical analysis of the hydrogen-reduced cells, a new method of measuring diffusion length in Cu_2O, and measurement of the absorption coefficient of Cu_2O. The factor most improved was the open circuit voltage, V/sub oc/, which was increased from 0.35 V to 0.7 V.

31817 **(DOE/ET/23034—T2) Amorphous Si solar cells. Third quarterly report, 1 July 1979-30 September 1979.** Dalal, V.L. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). 1 Nov 1979. Contract AC03-79ET23034. 46p. NTIS, PC A03/MF A01.

A new technique, using controlled DC voltages in addition to RF voltage, was developed to deposit a-Si:H and a-Si:F,H,O, films. This technique allows the growth of films with uniform morphology and yet avoids ion-induced damage. Reproducible films with high photoluminescence efficiency, indicative of low defect densities, have been grown. A new measurement technique, thermo-electric power (TEP), has been used to measure the movement of the Fermi level in n and p-doped materials. Simultaneous measurements of TEP and conductivity have revealed that the Fermi level in n-type a-Si:F,H can be moved quite easily by doping, and that it probably moves into the conduction band at 75 ppM AsH_3 doping. The conductivity of n-type fluorinated a-Si is approximately 10^3 times higher than the best hydrogenated a-Si. However, p-type fluorinated films are not significantly different from p-hydrogenated a-Si. Bandgap measurements on B-doped a-Si have revealed that B doping, even at low levels, leads to the formation of B:Si alloy with resultant bandgap shrinkage. p^+in^+ junctions have been made in hydrogenated a-Si. They show good I-V characteristics, are photovoltaic, and V/sub oc/ = 755 mV has been obtained. A heterojunction model has been developed which partially explains the poor collection efficiency of p-i-n junctions made with B-doped p layers. A design, consisting of using a wider gap a-Si to make the P-layer so that shrinkage due to B-doping would result in a pseudo-homojunction instead of a low-gap heterojunction, has been evolved. (LEW)

31818 **(DOE/ET/60058—T1) Cooperative program of applied energy research and technology development. Final technical report, October 1, 1979-December 31, 1980.** (Atlanta Univ., GA (USA). Dept. of Chemistry; Georgia Inst. of Tech., Atlanta (USA). Engineering Experiment Station). 1980. Contract FG05-79ET60058. 140p. NTIS, PC A07/MF A01. Order Number DE81028916.

This represents the final technical report on a number of studies conducted by groups at Atlanta University and the Georgia Institute of Technology Engineering Experiment Station during the fifteen month period, October 1979 through December 1980. These efforts were proposed as exploratory studies in the area of alternative energy technologies as preliminary work leading to a multi-year program of specific developmental efforts. Topics chosen were supportive of on-going research programs at the two institutions. Work proposed included pertinent literature search, computer modeling, initial choices of systems, and preliminary parametric studies. Separate abstracts have been prepared for each task for inclusion in the Energy Data Base. (DMC)

31819 **(DOE/JPL/954339—81/21) Evaluation of selected chemical processes for production of low-cost silicon (Phase III). Final report, July 10, 1978-January 31, 1981.** Blocher, J.M. Jr.; Browning, M.F.; Seifert, D.A. (Battelle Columbus Labs., OH (USA)). 31 Mar 1981. Contract NAS-7-100-954339. 106p. NTIS, PC A06/MF A01. Order Number DE81029744.

As a phase of a program to establish the engineering feasibility of the process for producing silicon by the zinc vapor reduction of silicon tetrachloride, a Process Development Unit (PDU), which consisted of the four major units of the process, was designed, installed, and experimentally operated. The PDU was sized to 50MT/Yr. The deposition took place in a fluidized bed reactor. As a consequence of the experiments, improvements in the design and operation of these units were undertaken and their experimental limitations were partially established. A parallel program of experimental work demonstrated that: (1) zinc can be vaporized for introduction into the fluidized bed reactor, by direct induction-coupled rf energy; (2) residual zinc in the product, expected to be of the order of 100 ppM by weight, can be removed by heat treatment below the melting point of silicon; however, deferring the zinc removal until the silicon is melted in the sheet-forming process is shown to be an attractive option; (3) current efficiencies of 94 percent and above, and power efficiencies around 40 percent are achievable in the laboratory-scale electrolysis of $ZnCl_2$.

31820 **(DOE/JPL/954521—81/15) Integral glass encapsulation for solar arrays. Final report.** Landis, G.A.; Younger, P.R. (Spire Corp., Bedford, MA (USA)). Jul 1981. Contract NAS-7-100-954521. 78p. NTIS, PC A05/MF A01. Order Number DE81029745.

The technology of electrostatic bonding as an encapsulation technique for terrestrial solar arrays has been developed. The process produces full integral, hermetic bonds with no adhesives or pottants. Demonstration panels of six solar cells on a single glass superstrate were produced. Electrostatic bonding was also developed as a means of making the cell front contact. A metal mesh is trapped into contact with the cell front during the bonding process. Demonstration six-cell panels using the bonded mesh as the only cell front contact were produced. Exploratory development was done on the possibility of using lower cost glass, with a higher thermal expansion mismatch to silicon, by making lower temperature (250 to 300°C) bonds. This was shown to require a planar surface cell (no front contacts). Demonstration panels of twelve 3″ round wafers on a 12 x 18″ glass sheet were made.

31821 **(DOE/JPL/955894—3) Integrated residential photovoltaic array development. Quarterly report No. 3.** Shepard, N.F. Jr. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). 14 Aug 1981. Contract NAS-7-100-955894. 85p. NTIS, PC A05/MF A01. Order Number DE81029747.

The design details of an optimized integrated residential photovoltaic module/array are presented. This selected design features a unique waterproofing and mounting scheme which was devised to simplify the installation procedures by the avoidance of complex gasketed or caulked joints, while still maintaining a high confidence that the watertight integrity of the integral roofing surface will be achieved for the design lifetime of the system. The production and installation costs for the selected module/array design are reported for a range of annual production rates as a function of the cost of solar cells.

31822 **(DOE/JPL/956045—81/1) Silicon production process evaluation. Quarterly technical progress report (I), May 18-July 31, 1981.** (Texas Research and Engineering Inst., Inc., Groves (USA)). Aug 1981. Contract NAS-7-100-956045. 14p. NTIS, PC A02/MF A01. Order Number DE81028944.

Chemical engineering analysis of the HSC process (Hemlock Semiconductor Corporation) for producing silicon from dichlorosilane has been initiated. For the preliminary process design, a process flowsheet is provided which best represents the HSC process at this point in time and which should be used for the chemical engineering analysis of a 1000 MT/yr plant for solar cell grade silicon. Major efforts in the chemical engineering analysis of the HSC process were devoted to the preliminary process design of a plant to produce 1000 MT/yr of silicon using the technology. Progress and status for the plant design are reported for the primary activities of base case conditions (60%), reaction chemistry (50%), process flow diagram (35%), energy balance (10), property data (10%), and equipment design (5%).

31823 **(DOE/SF/10610—T1) Research on lattice-mismatched semiconductor layers. Final report.** Cooper, C.B. III. (Varian Associates, Inc., Palo Alto, CA (USA)). Nov 1980. Contract AC03-79SF10610. 61p. NTIS, PC A04/MF A01.

The epitaxial growth of AlGaAsSb and the component binary and ternary alloys by organometallic vapor phase epitaxy (OM-VPE) is reported. OM-VPE growth of the binary compounds, GaAs and GaSb, and ternary compounds, AlGaAs, AlGaSb, AlAsSb, and GaAsSb, are discussed with emphasis on the Sb-containing alloys. Growth parameters are reviewed in some detail. It is noted that the growth temperatures and ratio of input fluxes for the growth of Sb-rich alloys are considerably different from the conditions for the growth of As-rich alloys. The results from the study of the binary and ternary components are integrated to grow the quaternary, AlGaAsSb. The work has contributed substantially to the exploration of III-V compound materials which can be grown by OM-VPE. Three papers on work by Varian are appended: The Organometallic VPE Growth of GaSb and GaAsSb using Trimethylantimony by Cooper, Saxena, and Ludowise; Multigap Solar Cell Requirements and the Performance of AlGaAs and S; Cells in Concentrated Sunlight by Moon, James, Vander Plas, Yep, Antypas and Chai; and The Organometallic VPE Growth of GaAs/sub 1-y/Sb/sub y/ Using Trimethylantimony and Ga/sub 1-x/In/sub x/As Using Trimethylarsenic by Cooper, Ludowise, Aebi and Moon.

31824 **(EPRI-AP—1940) Technical and economic assessment of solar thermophotovoltaic conversion. Final report.** Koechner, W.; Verdun, H.R.; Wyeth, N.C. (Science Applications, Inc., McLean, VA (USA)). Jul 1981. 190p. NTIS, PC A09/MF A01. Order Number DE81903762.

The methodology, analysis, and results are presented of a technical feasibility study and economic assessment of the solar thermophotovoltaic (STPV) conversion concept, aimed at large-scale electric utility applications. After consideration of several options, a conceptual system arrangement was chosen and analyzed to provide scoping calculations for STPV system configuration, size, performance, and cost. Baseline designs were selected for the optical and converter subsystems, and a detailed analysis of the performance of these subsystems was made using mathematical models and computer codes. The various sybsystems operating parameters were related to overall system performance and cost, and a minimum cost/power output point was found for the conceptual system. The primary collector structural design adopted for the cost analysis was similar to that used in parabolic dish antennae, while the mechanical structure of the primary mirror elements was assumed similar to the design for the DOE heliostat modules. The cost analysis has reasonable economic implications for a conceptual system design at this stage of development. Significant technical problem areas need to be resolved. Engineering and technical aspects related to these areas and their system components unique to the STPV concept were studied to the point at which potential problems were identified. Recommendations for future work in the development of this concept are provided.

31825 **(LBL—12960) Three lectures on photosynthetic plants as renewable sources of chemicals and energy.** Bassham, J.A. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 40p. (CONF-810751—1). NTIS, PC A03/MF A01. Order Number DE81028877.

From 2. international symposium on non-conventional energy; Trieste, Italy (14 Jul 1981).

The advantages and disadvantages for using biomass for the production of fuels and chemicals are listed. The mechanisms and efficiency of photosynthesis in green plants are discussed. The production of high energy liquid fuels from biomass is described. Methods for improving productivity of green plants for biomass production are presented. (DMC)

31826 **(ORAU—181A) Executive summary of some employment and earning implications of regional biomass energy utilization: New England and the Cornbelt states.** Bell, S.E.; Gove, R.M.; Little, J.R. (Oak Ridge Associated Universities, Inc., TN (USA)). Aug 1981. Contract AC05-76OR00033. 21p. NTIS, PC A03/MF A01. Order Number DE81028522.

Because of their abundant forest and agricultural biomass resources, New England and the Cornbelt are likely to grow considerably in the development of biomass energy systems during the next decade or two. Observations of 189 specific biomass-related operations suggest that substantial employment and earnings could be generated by this activity. Forty thousand or more permanent jobs might be created in New England's wood energy industry by the end of the century. If alcohol-fuel use continues to grow, even greater potential for employment in biomass energy exists in the Cornbelt states. The associated earnings would be quite substantial for both regions. The direct combustion of wood and activities related to alcohol-fuel producion are expected to be the major contributors to biomass energy production, employment, and earnings; but other biomass systems show some potential as well. Energy extraction from municipal waste, anaerobic digestion of animal manure, and other biomass conversion systems will all generate employment as they grow in use. An important characteristic of these jobs is that they tend to be for unskilled and semiskilled workers and are likely to be concentrated in rural areas, where the stimulus to the local economy can be substantial.

31827 **(ORAU—182) Education and training implications of biomass energy system use.** Bell, S.E.; Gove, R.M.; Little, J.R. (Oak Ridge Associated Universities, Inc., TN (USA)). Aug 1981. Contract AC05-76OR00033. 44p. NTIS, PC A03/MF A01. Order Number DE81029956.

Direct observations of 189 biomass-related operations combined with existing reports, feasibility studies, and expert opinion serve as the basis for this assessment of the education and training implications of biomass energy system use. The number of permanent jobs in activities related to biomass energy production could easily reach the hundreds of thousands by the end of the century. However, national employment related to biomass energy will represent only a very small portion of the employment in any major occupational category. In addition, an analysis of occupational skill requirements suggests that the impacts on education and training institutions are likely to be minimal. Regional shortages could develop for foresters, forestry technicians, chemists, laboratory technicians, process operators, and certain engineers; but these are likely to be in response to economy-wide growth rather than biomass energy-related activity alone.

31828 **(PNL-SA—9618) Biomass energy utilization in the Pacific Northwest: impacts associated with residential use of solid fuels.** Petty, P.; Hopp, W.; Chockie, A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 23p. (CONF-810674—3). NTIS, PC A02/MF A01. Order Number DE81029137.

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The Pacific Northwest Region, including Washington, Oregon, and Idaho, is the geographic area for which an impact assessment of the residential use of solid fuels is performed. Increased use of solid fuels in the residential sector has led to a marked decline in per household use of other forms of energy. An estimate of the potential energy contained in the fuelwood burned annually and an estimate of the mean conversion efficiency of the regional capital stock of woodburning appliances leads to a reasoned assessment of the contribution of wood energy to the residential energy use in the region. The use of solid fuels has been associated with an increase in the incidence of residential fires nationally. This is also true of the Pacific Northwest Region. An estimate is made of the economic costs attributable to this source of fire incidence. An additional area of concern relates to the harvesting practices of hundreds of individuals, cutting fuelwood for their own use. Statistics describing injuries and deaths per Btu in the commercial logging industry are used as a basis for an estimate of injuries and deaths resulting from the increased collection of forest residues and fuelwood by private woodcutters. This analysis indicates that the private harvest of fuelwood may be extremely costly in terms of injuries and deaths suffered by private woodcutters in the region.

31829 **(SERI/PR—8062-1-T12) Zn_3P_2 as an improved semiconductor for photovoltaic solar cells. Tenth quarterly report, December 1, 1980-February 28, 1981.** (Solar Energy Research Inst., Golden, CO (USA); Delaware Univ., Newark (USA). Inst. of Energy Conversion). 1981. Contract AC02-77CH00178. 49p. NTIS, PC A03/MF A01. Order Number DE81025587.

Studies of ZnO/Zn_3P_2 heterojunction devices were done in an effort to establish the origin of the low open circuit voltage. The studies include activation energy determination from J_0 vs. T measurements, dark current-voltage characteristics, and diffusion voltage determination by high frequency capacitance-voltage measurements. A band model of the ZnO/Zn_3P_2 device is determined from the experimental data. Experiments to develop oriented Zn_3P_2 crystals are reported. The optical absorption and photoluminescence spectra of Mg_3P_2 has been measured, and the diffusion coefficient of magnesium in Zn_3P_2 has been measured at 75°C and 150°C using a spectral response method. Diffusion of aluminum is also measured. The diffusion voltage of p/n junction devices has been determined. Work on reducing the series resistance of thin film devices and thus improving the fill factor is reported. (LEW)

31830 **(SERI/PR—8136-1-T4) Development of high-efficiency-cascade solar cells.** (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 5p. NTIS, PC A02/MF A01. Order Number DE81028145.

A comparative analysis of Mg- and Be-diffused GaAsSb junctions is briefly described and the major results lead to the conclusion that Mg may be more suitable as the bottom cell dopant since it will be affected less during subsequent layer growth. Increasing the number of grading layers with the composition of the bottom cell from one to six, the open circuit voltage increased from 0.3 to over 0.5 V. Results of the OM-CVD growth of GaAsSb are reported. Photoluminescence in the layers is briefly mentioned. A contract management summary report is included. (LEW)

31831 **(SERI/PR—9233-1-T1) Investigation of photovoltaic mechanisms in polycrystalline thin-film solar cells. First quarterly report, August 1,1980-October 31 1980.** Temofonte, T.A. (Solar Energy Research Inst., Golden, CO (USA)). 3 Apr 1981. Contract AC02-77CH00178. 18p. NTIS, PC A02/MF A01. Order Number DE81027272.

Initial efforts focussed on exploring the role of atomic hydrogen on silicon surfaces. The atomic hydrogen was generated using an inductively coupled plasma. Comparisons using Auger sputter profiling were made of hydrogenated silicon surfaces, deliberately oxidized silicon surfaces and silicon surfaces having a native oxide. The auger spectrum of a hydrogenated silicon surface is initially qualitatively similar to that for an oxidized surface. Distinct differences emerge as a function of sputtering depth, viz., the ratio of free silicon to bonded silicon decreases first before finally decreasing. This implies a significantly different surface composition for hydrogenated silicon compared to oxidized silicon.

31832 **(SERI/PR—9318-1-T2) Optimization of transparent electrode for solar cells. Technical progress report, 15 December 1980-15 June 1981.** Gordon, R.G. (Harvard Univ., Cambridge, MA (USA)). 1981. Contract AC02-77CH00178. 5p. NTIS, PC A02/MF A01. Order Number DE81023359.

Fluorine-doped tin oxide films prepared from highly purified tetramethyl tin (TMT) were compared with films prepared under identical conditions using less pure TMT. No effects due to impurities were found. The use of thermocouples to measure the temperature of glass surfaces is found to be unsatisfactory, and the need is found for an infrared emission thermometer. Effects of impurities from glass substrates are briefly discussed. Conditions for preparing samples are given. (LEW)

31833 **Long-term biomass research.** *EPRI (Electric Power Research Institute) Journal ;* **6**: No. 2, 29-32(Mar 1981).

Washington Report.

Some of DOE's long term R and D programs for biomass are summarized in this article. These include research efforts in the fields of anaerobic digestion, energy farming, short rotation cultivation and aquatic farming. (DMC)

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 32150

31834 (DOE/ET/20279—125) Simulated performance of the stand-alone photovoltaic system at Natural Bridges National Monument. Grossman, B.L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Mar 1981. Contract AC02-76ET20279. 39p. NTIS, PC A03/MF A01. Order Number DE81027274.

A computer model was used to describe and analyze the individual system components and the performance of the system as a whole. Various methods of looking at system performance have been identified and explored: available array energy, yearly energy flow, and load categorization. These provide a basis for design and operational refinements as well as a meaningful reference for future analyses using actual data. Comparison of the simulation with measured data is good.

31835 (DOE/ET/20279—139) Materials, processes and testing laboratory residential technical progress report, October-December 1980, January -February 1981. Forman, S.E.; Themelis, M.P. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 15 Apr 1981. Contract AC02-76ET20279. 15p. NTIS, PC A02/MF A01. Order Number DE81029460.

The US Department of Energy has set a 20-year lifetime goal for terrestrial photovoltaic modules. In its capacity as a Residential Photovoltaic Field Test and Applications Center, Massachusetts Institute of Technology Lincoln Laboratory has established and is monitoring experimental residential test sites in various locations of the United States. These sites contain either real or simulated residences coupled with photovoltaic modules from several manufacturers as well as the necessary balance-of-system components. Tests reported include visual and electrical inspection of modules, flash testing, and determination of module I-V curves.

31836 (DOE/ET/20279—147) Photovoltaic systems performance experience. Solman, F.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 8p. (CONF-810526—39). NTIS, PC A02/MF A01. Order Number DE81025725.

From 15. IEEE PV specialists conference; Orlando, FL, USA (11 May 1981).

The photovoltaic power systems at Natural Bridges National Monument in southeastern Utah and at radio station WBNO in Bryan, Ohio, provide some early reliability experience and case histories on failures and repairs of large photovoltaic systems. They are used here to illustrate potential sources of system outages and measures that can be taken to improve the reliability and repair economy of present and future PV systems. Both systems have experienced lighting strikes and the results are reported.

31837 (DOE/ET/20279—150) Solar photovoltaic residential project. Project integration meeting, agenda and abstracts. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1981. Contract AC02-76ET20279. 63p. (CONF-8106143—(Absts.)). NTIS, PC A04/MF A01. Order Number DE81028433.

From Solar photovoltaic residential project integration meeting; Cambridge, MA, USA (24 Jun 1981).

Thirty-three abstracts are presented of papers covering residential photovoltaic design, economics and requirements, balance of system components, PV/thermal collectors, PV interfaced with passive solar design, and utilities-related aspects. (LEW)

31838 (MIT-EL—80-023) Mobile-component housing and solar energy: the possibilities. Nutt-Powell, T.E.; Furlong, M. (Massachusetts Inst. of Tech., Lexington (USA); Harvard-MIT Joint Center for Urban Studies, Cambridge, MA (USA)). Apr 1980. Contract AC02-76ET20279. 59p. NTIS, PC A04/MF A01. Order Number DE81029702.

The possibilities for acceptance of PV among different modes of housing construction are considered. The focus is on that form of housing production defined as mobile-component housing, a type of housing built in a factory to a single national construction standard. The first section describes the structure of the manufactured housing industry. It provides definitions and terminology necessary to a discussion of mobile-component housing. It then reviews the production activity and approach, distribution, consumer and financing for this mode of housing. The second section presents the product characteristics of mobile-component housing. The third section reviews solar technologies, and discusses their relation to mobile-component housing. The fourth section focuses specifically on factors influencing receptivity to solar by the mobile-component housing industry. The conclusion summarizes the analysis as it relates to the possibilities for photovoltaics in mobile-component housing.

31839 (SAND—80-7170) Design of a photovoltaic system with on-site storage for a Southwest all-electric residence. Mehalick, E.M.; Felice, R.; Tully, G.F.; Johnson, J.; Parker, J.; O'Brien, G. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1981. Contract AC04-76DP00789. 220p. NTIS, PC A10/MF A01. Order Number DE81029282.

The design of a photovoltaic residence employing on-site storage has been developed for a south-western site. Performance data is provided for Phenix and Albuquerque locations. The roof mounted array is typical of projected retrofit installations. Detailed installation and electrical drawings are provided.

31840 (SAND—81-7030) Investigation of a family of power conditioners integrated into a utility grid: final report Category I. Wood, P.; Putkovich, R.P. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 107p. NTIS, PC A06/MF A01. Order Number DE81029394.

A study was conducted of the requirements for and technologies applicable to power conditioning equipment in residential solar photovoltaic systems. A survey of companies known or thought to manufacture power conditioning equipment was conducted to asses the technology. Technical issues regarding ac and dc interface requirements were studied. A baseline design was selected to be a good example of existing technology which would not need significant development effort for its implementation. Alternative technologies are evaluated to determine which meet the baseline specification, and their costs and losses are evaluated. Areas in which cost improvements can be obtained are studied, and the three best candidate technologies--the current-sourced converter, the HF front end converter, and the programmed wave converter--are compared. It is concluded that the designs investigated will meet, or with slight improvement could meet, short term efficiency goals. Long term efficiency goals could be met if an isolation transformer were not required in the power conditioning equipment. None of the technologies studied can meet cost goals unless further improvements are possible. (LEW)

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 32109, 32150

31841 (ATR—75(7523-02)-2) Highlights of the solar total energy technology symposium. (Aerospace Corp., El Segundo, CA (USA). Energy and Transportation Div.). 1975. Contract AT03-76SF91101. 111p. (CONF-750787—(Absts.)). NTIS, PC A06/MF A01. Order Number DE81026904.

From Highlights of the solar total energy technology symposium; Albuquerque, NM, USA (10 Jul 1975).

Twenty-one papers on various aspects of solar total energy systems are summarized. General overviews are presented. Studies are presented on the design approaches to and economics of solar total energy systems sized for various applications. Systems engineering and the design of various subsystems, particularly power cycles, collectors, and energy storage, are discussed. (LEW)

31842 (DOE/SF/10499—T47) 5 Megawatt Solar Thermal Test Facility: statement of capabilities. Supplemental data: checklist responses from contractors. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA); Black and Veatch, Kansas City, MO (USA); Honeywell, Inc., Minneapolis, MN (USA); Georgia Inst. of Tech., Atlanta (USA)). Aug 1975. Contract AC03-79SF10499. 47p. NTIS, PC A03/MF A01. Order Number DE81026934.

Facility requirements for testing of research experiment heliostats, receivers, and termal storage are described by Honeywell, Martin Marietta, and McDonnell Douglas, and requirements for heliostats only are given by Boeing Engineering and Construction. For heliostats, receivers, and thermal storage, the system configuration, instrumentation, controls, and support facilities are specified. The cycle and solar flux are specified for the receivers, and the working cycle and safety are specified for the thermal storage. (LEW)

31843 (DOE/SF/10499—T48) 5 Megawatt Solar Thermal Test Facility: facility capabilities definition. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA); Black and Veatch, Kansas City, MO (USA); Honeywell, Inc., Minneapolis, MN (USA); Georgia Inst. of Tech., Atlanta (USA)). 20 Oct 1975. Contract AC03-79SF10499. 123p. NTIS, PC A06/MF A01. Order Number DE81026543.

The major objective of the fully operational facility will be to test experimental receiver designs. Secondary objectives include testing of heliostat and thermal storage subsystems. Additional capabilities to meet the needs for advanced systems testing, high temperature processing, and high temperature materials research will be implemented as demand and funding permit. The specific test capabilities required for the Pilot Plant Subsystem Research Experiments, advanced concepts, and other high temperature applications are described. The capabilities required to support these tests are then identified. Support capabilities include central control of the facility, instrumentation, data acquisition and reduction equipment, testing operations (e.g., receiver support tower, heat rejection equipment), laboratory areas, administration and public relations areas, personnel, and safety considerations.

31844 (DOE/SF/10499—T49) 5 Megawatt Solar Thermal Test Facility: environmental assessment. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA); Black and Veatch, Kansas City, MO (USA); Honeywell, Inc., Minneapolis, MN (USA); Georgia Inst. of Tech., Atlanta (USA)). 9 Aug 1976. Contract AC03-79SF10499. 64p. NTIS, PC A04/MF A01. Order Number DE81024338.

The 5 Megawatt Solar Thermal Test Facility, its anticipated benefits, and the environment affected are described. The 115-acre site is located southeast of Albuquerque. The potential environmental impacts associated with the facility's construction and operation are evaluated, and no significant adverse environmental impact is expected. No significant effects are anticipated from postulated facility accidents. (LEW)

31845 (DOE/SF/10802—T4) Economic analysis of the unified heliostat array. (Veda, Inc., Camarillo, CA (USA)). 7 Nov 1980. Contract AC03-80SF10802. 395p. NTIS, PC A17/MF A01. Order Number DE81026698.

The Unified Heliostat Array (UHA) is comprised of conventional two-axis heliostats mounted on a terraced south-facing wall of a single structure. The arrangement of heliostats on the array is chosen to eliminate or control the degree of inter-heliostat shading and blocking. The UHA was investifated as to cost and optical performance. Two heliostats, the Veda Industrial Heliostat (VIH) and the Repowering Heliostat were investigated in conjunction with the UHA. The UHA was found to be a viable candidate for solar thermal central receiver applications. The UHA-VIH combination was shown to provide very high flux densities and to be suitable for high temperature applications in the 1000°K to 2000°K range. These temperatures were shown to be achievable even with very small (1 MWt) collector fields.

31846 (SAND—80-8049, pp 215-224) Preliminary heat pipe testing program. Westsik, J.H. (Bechtel National, Inc., San Francisco, CA); Bienert, W. Jan 1981. NTIS, PC A12/MF A01.

From Solar central receiver semi-annual meeting; San Francisco, CA, USA (15 Oct 1980).

The test program is to subject representative heat pipes to cyclic operation simulating the amplitude and rate of temperature change likely to be encountered in an actual receiver. The reference system is a combined cycle central receiver solar thermal power system. The power system and receiver and transients are described. The design and installation of test article heat pipes are discussed. Test parameters are listed and the test status is reported. (LEW)

31847 (SERI/TR—742-885) Standards application and development plan for solar thermal technologies. Cobb, H.R.W. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 218p. NTIS, PC A10/MF A01. Order Number DE81030310.

The Solar Energy Research Institute, at the request of DOE, is developing a Quality Assurance and Standards (QA and S) Plan for solar thermal technologies. Unlike the legislative directives concerning standards for the Photovoltaic (PV) and Solar Heating and Cooling of Buildings (SHAC) programs, which required prior development of criteria, relevant legal requirements for ST involved developing sound commercial practices. Since standards development and implementation of PV and SHAC technologies were begun earlier, a lessons-learned approach is used to develop a QA and S plan for ST. Thus, the keystone of the plan is a series of functional and standards matrices, contained in this report, developed from input from ST users and from the industry that will be continually reviewed and updated as commercial aspects develop. The matrices highlight codes, standards, test methods, functions and definitions that need to be developed. They will be submitted through ANSI for development by national consensus bodies. A contingency action is proposed for standards development if specific input is lacking at the committee level or if early development of a standard would hasten commercialization or gain needed jurisdictional acceptance. Agency funding will be sought before consensus review to support development of draft standards by specialists, laboratories, and consultants where qualifying requirements apply.

31848 (DOE/SF/10738—T3) Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma. (Black and Veatch Consulting Engineers, Kansas City, MO (USA)). [nd]. Contract AC03-79SF10738. 26p. NTIS, PC A03/MF A01. Order Number DE81027032.

The solar repowering project involves the development of a site specific conceptual design of a solar central receiver steam generation system for operation in conjunction with an existing 150 MWe gas and oil fired steam electric generating unit. Three documents are included. The first defines the subsystem characteristics, system environmental requirements, and plant conceptual design data requirements. Plant conceptual design data requirements are defined, and an economic and performance evaluation of the repowered plant is provided as well as the overall plant cost data. The second document presents the rationale for not utilizing thermal energy storage. The third outlines the tradeoff studies related to plant-side aspects, the collector subsystem and receiver sybsystem. (LEW)

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 31818, 32136, 32136, 32153, 32157

31849 (CONF-811007—6) Fuels and chemicals made from solar energy. Mathur, V.K.; Manasse, F.K.; Lakshmanan, S. (New Hampshire Univ., Durham (USA). Dept. of Chemical Engineering). 1981. Contract AC02-79ET21067. 10p. NTIS, PC A02/MF A01. Order Number DE81025018.

From 2. world congress of chemical engineering; Montreal, Canada (4 Oct 1981).

The application of high temperature solar energy for the production of fuels and chemicals from various feed stocks is re-

viewed. The promises and problems of this technology are highlighted. The New Hampshire University two-stage Sun Gas process is described. The role of chemical engineers and the future of Sun Fuels and chemicals are discussed.

31850 (DOE/CS/30202—T3) Evaluation of hybrid solar/fossil Rankine-cooling concept. Curran, H.M. (Hittman Associates, Inc., Columbia, MD (USA)). Nov 1980. Contract AC03-79CS30202. 29p. NTIS, PC A03/MF A01.

The hybrid solar/fossil Rankine cycle is analyzed thermodynamically to determine fuel use and efficiency. The hybrid system is briefly compared with solar organic Rankine systems with a fossil fuel auxiliary mode, and with geothermal resources. The economic evaluation compares the present value of the superheater fuel cost over the system lifetime with the first cost reduction obtained by substituting a hybrid solar/fossil Rankine engine for an organic Rankine engine. The economics analysis indicates that even if the hybrid solar/fossil Rankine cooling system were developed to the point of being a commercial product with an economic advantage over an otherwise equivalent solar organic Rankine cooling system, it would gradually lose that advantage with rising fuel costs and decreasing collector costs. From the standpoint of national fossil fuel conservation, the hybrid concept would be preferable only in applications where the operating duration in the solar/fossil mode would be substantially greater than in the fossil fuel-only auxiliary mode. (LEW)

31851 (DOE/CS/30259—6) REPEAT facility. Report for May, June, July. Winn, C.B. (Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.). Aug 1981. Contract AS02-80CS30259. 79p. NTIS, PC A05/MF A01. Order Number DE81028156.

Work on the construction of the REPEAT facility, a test facility for passive and hybrid solar heating systems, is reported. Work on a double envelope test cell has been completed and is reported in a paper appended. The work consisted of developing a simulation program for envelope-type passive solar systems, constructing an envelope test cell, collecting data to validate the program, and then applying the program to determine the best envelope-type design. A low cost monitoring system is being developed using a dedicated microprocessor system, an inexpensive, high accuracy A/D converter, and minimum system hardware. A method for determining the average temperature and the average daily temperature variation inside a passively heated solar building is presented in an appended paper by the author. (LEW)

31852 (DOE/SF/10597—T2) Analysis of the technical and economic feasibility of solar feedwater heating for El Paso Electric Company. (Stone and Webster Engineering Corp., Boston, MA (USA)). Feb 1980. Contract AC03-79SF10597. 90p. NTIS, PC A05/MF A01. Order Number DE81022927.

Work to update and document previous studies performed by El Paso Electric Company and Stone and Webster Engineering Corporation on the economic feasibility of a solar feedwater heating methodology not previously reported is described. Three tasks are described. Task 1 evaluates and provides a detailed critique of Franklin Institute Research Laboratories and Sheldahl, Incorporated, analysis of the economics of and fuel savings of solar-powered feedwater heating of a fossil-fueled electric generating plant. It provides a detailed comparison of El Paso Electric Company analysis and the above analyses and defines significant differences in assumptions, methodologies, and conclusions. Task 2 evaluates the economic benefits which could be derived by solar feedwater heating of El Paso Electric's fossil plants where the conversion from gas to oil has caused a loss of generating capacity. Task 3 expands the already developed conceptual design (for Rio Grande Unit 8 of El Paso Electric Company) beyond that used in making initial cost estimates for the proposal submittal and provides a detailed documented cost breakdown of the design which will permit evaluation of whether the design can be economically justified in the light of economic analysis of Tasks 1 and 2. The costs of system installation, any costs attributed to plant downtime, and operations and maintenance costs are presented. (MCW)

31853 (DOE/SF/10742—T4(Vol.1)) United States Gypsum Plant Solar Retrofit Program. Volume 1: topical report. (Boeing Engineering and Construction Co., Seattle, WA (USA); United States Gypsum Co., Sweetwater, TX (USA)). Mar 1980. Contract AC03-79SF10742. 94p. NTIS, PC A05/MF A01. Order Number DE81024222.

A program is described to develop a conceptual design of a system to supply solar-heated process air to a gypsum board drying kiln. The subsystem analyses and trade studies for selecting a site-specific system configuration are described, and initial results of the plant conceptual design and performance estimates are presented. The solar retrofitted plant, located east of Sweetwater, Texas, will have a heliostat field and central receiver. (LEW)

31854 (DOE/SF/10742—T4(Vol.2)) United States Gypsum Plant Solar Retrofit Program. Volume 2: system requirements specification. (Boeing Engineering and Construction Co., Seattle, WA (USA); United States Gypsum Co., Sweetwater, TX (USA)). Mar 1980. Contract AC03-79SF10742. 43p. NTIS, PC A03/MF A01. Order Number DE81024221.

The general characteristics of a solar industrial retrofit plant are described. Performance and design requirements to be met by the plant are provided, and environmental criteria to be applied are given. The plant conceptual design, performance, and economic data to be provided for the solar additions are identified, as well as certain design data for the existing plant. (LEW)

31855 (LA—8889-MS) Attached-sunspace passive solar-heated residences: a study of nationwide patterns of economic feasibility for the existing housing stock. Roach, F.; Kirschner, C. (Los Alamos National Lab., NM (USA)). Jun 1981. Contract W-7405-ENG-36. 135p. NTIS, PC A07/MF A01. Order Number DE81026309.

Performance estimates for attached-sunspace passive solar-heated residences recently have been incorporated into the Los Alamos/UNM EASE III Model. These estimates are used to analyze the economic performance of a passive sunspace design when retrofitting onto an existing single-family home. Several key parameters are evaluated, including loan or mortgage terms, ownership period, resale potential, and competing conventional fuel prices. General economic and design parameters are combined in one version of life-cycle costing to evaluate the feasibility of both owner-built and contractor-built attached sunspaces for 220 regions in the contiguous US. The conventional fuel alternatives are natural gas, heating oil, electric resistance, and electric heat pump. The optimal sunspace design is determined for the fuel alternatives by minimizing the combined solar and conventional delivered cost of heat. An analysis of fuel used for space heating in existing homes is used to discuss the retrofit potential for the 220 regions. Results show that the prospect for conventional fuel displacement through retrofit of attached sunspace is very good, and that the design's economic performance is enhanced in regions with expensive conventional fuel alternatives.

31856 (LBL—11390) Description of an exact recursive method to simplify shading calculations. Nawrocki, A.D.; Kammerud, R. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 11p. (CONF-810405—16). NTIS, PC A02/MF A01. Order Number DE81027409.

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

An exact, recursive method called SHADE is described which attempts to simplify shading calculations as performed by a programmable calculator or microcomputer. Preliminary applications of SHADE using a Hewlett Packard HP-41C programmable calculation are outlined. In particular, for a given solar hour, SHADE is used to compute the following quantities for overhang and side fin combinations which shade various openings: the percentage of the total area of the opening which is shaded; the shaded area itself; the cosine of the angle of incidence between sun and glazing surface; the direct insolation at this surface, with and without shading; and the direct solar power at this surface, with and without shading. Hence, in its present HP-41C application, SHADE can be used in preliminary design and comparative analy-

ses of shading devices on an hourly, daily, or seasonal basis, provided that: (1) the fins and overhangs be square or rectangular, and lie in planes perpendicular to the plane of the opening; and (2) the opening itself be vertical and rectangular with arbitrary building azimuths. Design candidates include conventional overhangs and side fins, porches, and reveals. In principle, SHADE can be extended to awnings, slatted sun screens, and bevelled recesses; in addition, its HP-41C application can be extended to calculations of direct solar gain through vertical and non-vertical glazings, thereby providing a more useful tool in building heating and cooling load calculations.

31857 **(LBL—12752) Systems simulation and economic analysis for active solar cooling.** Warren, M.; Wahlig, M. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 3p. (CONF-810912—12). NTIS, PC A02/MF A01. Order Number DE81028015.

From Annual DOE active solar heating and cooling contractor's review meeting; Washington, DC, USA (Sep 1981).

A consistent methodology has been developed by which general solar cooling market capture goals have been translated into specific cost and performance goals for solar cooling systems and subsystems. Preliminary results indicate that realistic cost/performance goals can be established for active solar cooling systems and that, with aggressive development, these goals can be reached by the year 2000. As the technology develops, tax incentives will be required to bridge the gap between the actual costs and the cost goals, so that the scenario of an ever increasing share of market penetration can be maintained over the 1986 to 2000 time period.

31858 **(MASEC-CF—81-028) Summary of passive-solar-retrofit workshops.** (Mid-America Solar Energy Center, Minneapolis, MN (USA)). Jun 1981. Contract AC02-79CS30150. 12p. NTIS, PC A02/MF A01. Order Number DE81028146.

Efforts are described to provide training in the latest passive solar retrofit techniques to a wide sector of residential design and construction professionals. Three 20-hour passive solar single-family retrofit workshops in St. Louis, Toledo, and St. Paul were attended by 116 residential construction-related participants. Each of the three workshops is described. The workshop topics and workbook were evaluated by 65 participants, and suggestions were made for improvement. (LEW)

31859 **(MASEC/R—81-020) Principles of passive solar: a manual for training vocational - technical instructors.** (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Jul 1981. Contract AC02-79CS30150. 5p. NTIS, PC A02/MF A01. Order Number DE81027060.

The objectives, a summary, a report of the vo-tech workbook activity, and recommendations for further development concerning a manual written for training vocational-technical instructors are briefly mentioned. Development of a workbook on passive solar and energy-efficient construction for the building trades and architectural design instructors who are employed by vocational-technical schools is mentioned. (MCW)

31860 **(PB—81-132268) Residential Solar Data Center Mirads User's Guide. Final report.** Christopher, P.M.; Vogt, M.; Hall, D. (National Engineering Lab. (NBS), Washington, DC (USA)). Oct 1980. 145p. NTIS, PC A07/MF A01.

The Residential Solar Data Center Project staff in the Center for Building Technology, National Bureau of Standards, maintains a computerized data base containing non-instrumented residential data from the DOE/HUD Solar Heating and Cooling Demonstration Program. Data contained in the solar data base are accessible online to users of the NBS Center Computer via remote terminals with a data base retrieval software package called MIRADS (Marshall Information Retrieval And Display System). This document is a self-teaching user's guide to the solar data base. It is complete with the basic MIRADS language rules, examples of use, and a step-by-step walk-through of a typical interactive session. Appendices contain all the data element names and coded values needed to use the solar data with MIRADS, as well as many examples of actual computer sessions.

31861 **(SAND—79-8279-Vol.1) Design, cost and performance comparisons of several solar thermal systems for process heat. Volume I. Executive summary.** Eicker, P.J.; Eason, E.D.; Hankins, J.D.; Hostetler, L.D.; Iannucci, J.J.; Woodward, J.B. (Sandia National Labs., Livermore, CA (USA)). Mar 1981. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01. Order Number DE81029881.

Conceptual designs of central receiver, parabolic dish, and parabolic trough systems are obtained for several process heat applications. Cost and performance estimates are made for each of these designs and these are used to calculate levelized delivered process heat costs. The results indicate that central receiver systems will provide energy costs competitive with that afforded by the parabolic trough and parabolic dish systems over the range of demand sizes and temperatures studies - above 3 MW/sub t/ and above 200°F.

31862 **(SAND—81-8235) Solar thermal central receivers for industrial process heat generation: user views and recommendations for commercialization.** Fish, M.J. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01. Order Number DE81029611.

Results of recent meetings with several private industrial groups in which solar thermal central receivers were discussed in depth as a potential for industrial process heat generation are summarized. Topics covering potential economics, technical requirements, and actions to promote commercialization of the technology are presented. These findings are then translated into recommendations for commercialization in private industrial markets. Key points include the need for small scale systems integration projects in addition to the 10 MW/sub e/ plant under construction at Barstow, CA, and the adoption of financial incentives, such as tax credits, for getting the early commercial plants built. Finally, a comparison with an earlier study dealing with commercialization of central receivers in electric utility applications points out strong similarities between the two markets.

31863 **(SERI/TP—721-1138R) Low-cost passive-solar retrofits for new and existing mobile homes.** Brant, S.; Holtz, M. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 6p. (CONF-810925—17). NTIS, PC A02/MF A01. Order Number DE81028356.

From 6. national passive conference; Portland, OR, USA (8 Sep 1981).

Passive solar heating and cooling retrofit options can significantly reduce the energy consumption of new and existing mobile homes. This paper describes the initial efforts of the Solar Energy Research Institute to explore the solar potential for the existing stock of mobile homes and those in the production stage.

31864 **(SERI/TP—733-1278) Industrial process heat applications for solar-thermal technologies.** Feasby, D.; Kearney, D. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1981. Contract AC02-77CH00178. 9p. (CONF-811006—2). NTIS, PC A02/MF A01. Order Number DE81025934.

From International conference on energy use management--III; West Berlin, F.R. Germany (26 Oct 1981).

An overview is presented of selected solar industrial process heat (IPH) activities under development in the US. Included are a summary of the IPH field test program, status of solar thermal technologies, and results of specific technology/application matching and market studies. There is a large potential market for solar IPH in the United States. The near-term viability of solar technologies in the industrial sector is dependent upon both the economic and technical issues which vary depending on the application, plant site, and system selected.

31865 **(SOLAR/1046—81/50) Solar project description for living systems single family residence, Davis, California.** (Department of Housing and Urban Development, Washington, DC (USA); Boeing Co., Seattle, WA (USA)). 31 Aug 1981. Contract AB01-76CS31020. 75p. NTIS, PC A04/MF A01. Order Number DE81029743.

Two independent systems are described - a direct gain passive solar space heating system and an active domestic hot water

preheating system. Large south-facing windows and a clerestory skylight permit direct winter sun to enter the house. Solar energy thermal storage is provided by both water filled tubes and the concrete slab floor. Movable shutters and insulating curtains provide capability to reduce night heat losses. Summer overheat protection is provided by roof overhangs and by natural ventilation. A natural gas furnace and wood stove provide auxiliary space heat. The domestic hot water system has an array of liquid flat plate collector with a gross area of 53 square feet. Freeze protection is by draindown. An 82-gallon solar preheat tank supplies water to a conventional 20-gallon domestic hot water tank. The collector, storage, heating load, and auxiliary loads subsystems and modes of operation are described for both systems. The house is instrumented for thermal performance evaluation. Original cost estimates for provisioning and installation of the solar system are given. (LEW)

31866 **(SOLAR/1051—81/50) Solar project description for Colorado Sunworks: single family residence, Longmont, Colorado.** (Boeing Co., Seattle, WA (USA)). 1981. Contract AB01-76CS31020. 74p. NTIS, PC A09/MF A01. Order Number DE81028054.

A passive solar energy system for both space heating and domestic hot water preheating is described. The passive space heating system consists of a drum wall and direct-gain system. Heat losses are reduced by a Beadwall movable insulation. The vertically stacked drums near the south wall form a drumwell chimney where heated air rises through ceiling vents above the drums into an open plenum area between the roof and the ceiling of the rooms. Additional vents from this plenum on the north side of the house provide a path for the warm air into the room. Earth berms on the north, east, and west sides of the house, a one-foot covering of earth on the roof, and an entry vestibule are used. Cooling is enhanced by night ventilation. The hot water system consists of two 30-gallon tanks painted black and positioned next to the south wall. The house is fully instrumented for the National Solar Data Network. Original cost estimates for provisioning and installation of the solar system are given. (LEW)

31867 **(SOLAR/1084—81/50) Solar project description for Public Service Company of New Mexico (Lot 7) single-family residence, Rio Rancho, New Mexico.** (Boeing Co., Seattle, WA (USA)). 6 Aug 1981. Contract AB01-76CS31020. 58p. NTIS, PC A04/MF A01. Order Number DE81027853.

A solar space heating/domestic hot water system employing 150 square feet of air flat plate collectors and 20,000 pounds of rock for storage is described. The collector, storage, energy-to-load, and auxiliary heat subsystems and five modes of operation are described. Auxiliary space heating is provided by an electric strip heater in the air ducts. The hot water system consists of an 80-gallon solar preheating tank which supplies a 40-gallon conventional tank. An electric heating element provides auxiliary heating in the preheat tank. The house is instrumented for performance evaluation. Original cost estimates for provisioning and installation of the solar system are given. (LEW)

31868 **(TAC-STHC—81-001) Solar thermal heating and cooling: a bibliography with abstracts. Quarterly update, January-March 1981.** Bozman, W.R. (ed.). (New Mexico Univ., Albuquerque (USA). Technology Application Center). Apr 1981. 156p. Univ. of New Mexico, Albuquerque. Order Number DE81903774.

This annotated bibliography covers: demonstrations; system overviews; computer calculations, designs, models and simulations; thermal storage; architectural considerations; passive solar energy; air conditioning and cooling; domestic water heating; control systems; insolation, instruments, and monitoring systems; swimming pools; and greenhouses. An author index and a keyword index are included. (LEW)

31869 **(WSUN—25R) Installation guidelines for solar DHW systems in one-and two-family dwellings.** (Franklin Research Center, Philadelphia, PA (USA)). 1981. Contract AC02-80CS30149. 110p. NTIS, PC A06/MF A01. Order Number DE81026089.

Guidelines are provided which, together with the manufacturer's manual, helps the professional installation contractor or the skilled homeowner to install and fill a solar domestic hot water system. Pointers for maintenance and an installation checklist are provided. (LEW)

31870 **Evaluation of solar water heating and solar active cooling in New Mexico. Final report.** Lumsdaine, E.; Cherng, J.G. Santa Fe, NM; New Mexico Energy and Minerals Dept. (1981). 161p. (NP—81903394; EMD—2-65-2214).

The discussion of on-site performance of solar hot water systems covers the field study of the solar hot water systems located at Socorro High School, Socorro, New Mexico, and Springer High School, Springer, New Mexico. The design merits of the two solar systems are presented, as well as the principles of operation, instrumentation and data acquisition, and operation, repairs, and maintenance. The assessment study of solar active cooling systems concentrates on five solar active cooling systems: absorption (ammonia-water, water-LiBr), Rankine cycle vapor compression, desiccant dehumidification, vapor ejector cooling, and solar-assisted heat pump. It discusses the basic operation principles, the thermal performance characteristics, and the related technical and nontechnical aspects of the systems. Finally, a recommendation is made on the priority of solar active cooling systems for future research and development programs in New Mexico.

31871 **Energy conservation and solar energy use in the Wiehl outdoor swimming pool and multipurpose hall.** Biasin, K.; Dreisbach, K.; Fruehauf, H.J. pp 623-642 of Statusbericht Sonnenenergie. Bd. 1. Duesseldorf, Germany, F.R.; VDI (1980). (In German)

From International technical exhibition: solar technology '80 and sanitary technics - heating - air conditioning and 3. international solar forum; Hamburg, Germany, F.R. (24 - 27 Jun 1980).

In the Wiehl outdoor swimming pool and multipurpose hall, technical and scientific investigations on energy conservation have been carried out since 1977. The investigations are paid by BMFT, Bonn, and Department of Energy, Washington, D.C. The project will be terminated by the end of 1980. Some of the findings are presented. The 1978 annual reports and further publications give a detailed description. The Wiehl open-air swimming pool is opened from May 1 to the end of September. Its water is heated to a large extent by a solar collector system consisting of 1,100 collectors with a useful collector surface of 1,500 m^2.

31872 **100% solar home.** Carden, R. (Paul Smith's Coll., Paul Smiths, NY). pp 81-93 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The possibility of a completely solar heated home in the Adirondacks with no backup furnace is explored. The house is similar to an existing house with R-20 in the walls, ceiling, and floor. The existing house is off the ground on pressure treated telephone poles, is 20 feet by 40 feet and an an average of 9 feet off the ground, and has one air tight wood stove, using 2.5 cords of hardwood for the winter. Calculations made to explore converting this house to 100% solar include: heat required for December; heat loss per degree day; heat needed for 6 months; heat collected by month; heat stored in summer; people heat; and heat loss with house underground. (MCW)

31873 **Installation and first year operation of a solar hot water system.** Hazen, P.T. pp 105-117 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

Installation, operation, performance, and economics of a residential solar hot water system in Maryland are described. A system including three Solara all-copper 3' x 7' panels with block chrome paint and a waterlite non-reflective glass front was used. A drainback system uses water in the solar loop with automatic drainback to a 10-gallon tank when the pump is off. A description of the equipment and fixtures and design of the installation are presented. Operating data for the year (February 1979 to January 1980) are tabulated along with comparative operating data for February 1979

and 1980. Calculations are made for the payback period considering the use of oil, electricity, and gas for the backup water heater. (MCW)

31874 **Life-cycle model for solar heating system design and economic evaluation-Mesh.** Clark, J.A. (Univ. of Michigan, Ann Arbor). pp 159-193 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

Based on an extension of the solar design data developed by the Los Alamos Scientific Laboratory, a model is presented which allows for both design selection and economic optimization of solar heating system within the US. This model relates the life-cycle total cost of a solar heating system to the escalating cost of fuel, installed system costs per unit area of collector, the cost of capital (capital recovery factor under a mortgage contract), taxes, collector type, building load factor, degree-day heating factor, conversion efficiency of the back-up system, solar load fraction, and solar input-collector performance factors derived from the Los Alamos solar heating model. The influence of cost escalation in fuel is included by an inflation function determined by the analysis. The circumstances corresponding to a arbitrary and/or optimum (minimum total life-cycle cost) design condition are identified and explicitly determined. The influence of the principal governing parameters on solar heating desin and economics in the US is shown in a simple but complete form.

31875 **(DOE/CS/30149—T2) Passive solar residential Class C monitoring program in the Northeast region.** Saras, A.E. (Northeast Solar Energy Center, Boston, MA (USA)). [nd]. Contract AC02-80CS30149. 6p. NTIS, PC A02/MF A01. Order Number DE81028150.

The Class C Monitoring Program as performed under the Performance Evaluation of Passive/Hybrid Solar Heating and Cooling Systems Area Plan consists of a three-hour, on-site audit of passive solar homes to collect market and thermal data. The analysis of data gathered during the 200 home audits performed during 1980 and 1981 in the Northeast Region is highlighted. Similarities among passive solar homes and the attitudes and perceptions of their occupants are examined from initial solar decision through the first heating season of occupancy. Selected performance data are also examined.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 32389

31876 **(DOE/ER/10558—2) Integrated function nonimaging concentrating collector tubes for solar thermal energy. Technical progress report.** Winston, R. (Chicago Univ., IL (USA). Enrico Fermi Inst.). 25 Aug 1981. Contract AC02-80ER10558. 21p. NTIS, PC A02/MF A01. Order Number DE81029677.

A substantial improvement in optical efficiency over contemporary external reflector evacuated tube collectors has been achieved by integrating the reflector surface into the outer glass envelope. The design, fabrication and preliminary test results are described for a prototype collector based on this concept. Efficiencies above 40% up to nearly 300°C may be achieved. A comprehensive test program to measure performance and operational characteristics of a 2 m^2 panel (45 tubes) is just beginning.

31877 **(DOE/NASA/CR—161825) Design data package and operating procedures for MSFC solar simulator test facility.** (Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.). Jun 1981. Contract AI01-76CS31037. 95p. NTIS, PC A05/MF A01. Order Number DE81029808.

Design and operational data are provided for the MSFC Solar Simulator Test Facility. This simulation test facility was constructed to evaluate solar collector performance under simulated outdoor operating conditions. The primary goal of the facility is to evaluate the performance capability and worst case failure modes of collectors, which utilize either air or liquid transport media. The test facility is capable of simulating several environmental parameters such as solar radiation intensity, solar spectrum, collimation, and uniformity, and solar attitude. The facility is also capable of simulating wind conditions of velocity and direction, solar system conditions imposed on the collector such as transport media type and flow rate, collector fluid inlet temperature, and geometric factors of collectors tilt and azimuth angles. Testing in the simulator is performed to acquire collector efficiency data, the collector time constant, incident angle modifier data, and stagnation temperature values.

31878 **(PB—81-135741) Flat plate thermal solar collectors: a physical background.** Isakson, P. (Swedish Council for Building Research, Stockholm). 1980. 105p. NTIS, PC A06/MF A01.

The purpose of the report is to provide a physical background to the energy balance of flat plate solar collectors, and to give an idea of the wide range of literature available on the subject.

31879 **(SAND—80-0385) Frequency response analysis of fluid control systems for parabolic-trough solar collectors.** Schindwolf, R. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 29p. NTIS, PC A03/MF A01. Order Number DE81029293.

A linearized steady-state frequency response is derived for parabolic-trough collectors and for connecting piping that can be used in standard gain-phase analyses to evaluate system stability and closed-loop frequency response. The frequency-response characteristics of a typical collector string and piping are used in a gain-phase analysis to get some insight into the effect on system stability of various system parameters such as controller gain, sensor and controller-time constants, and sensor location.

31880 **Design and prototype testing of a solar heating and cooling roof/collector/radiation module. Final technical report, 1 April 1980-31 March 1981.** Conrad, G.R.; Pytlinski, G.T. Santa Fe, NM; New Mexico Energy and Minerals Dept. (Jul 1981). 169p. (NP—1904011; EMD—2-68-2228).

A test program was conducted to determine the potential of over 30 contemporary roof surfaces as solar collectors and nocturnal radiators. Color as well as material variations were involved, as well as several candidate thin-film glazings. Dark surfaces performed well for collection and radiation, while light or polished surfaces were satisfactory for radiation only. Two prototype roof/collector/radiator modules were built and tested to determine thermal performance. A corrugated galvanized steel module, tested with air and 40% ethylene glycol/water heat transfer fluids, yielded heat rejection rates as high as 65 Btu/h-ft^2, and under realistic summer night conditions the rates were 30 to 35 Btu/h-ft^2. The solar collection efficiency was 57% max. An asphalt roofing module was tested with and without a teflon glazing, using air only. The glazing aided solar collection, but had little effect on nocturnal radiation due to calm test conditions. The maximum solar collection efficiency was about 11%. The maximum heat rejection rate was 35 Btu/h-ft^2, and was 17 Btu/h-ft^2 under typical summer night conditions.

31881 **Specialized cleaning, finishing and coating processes.** Metals Park, OH; American Society for Metals (1981). 421p. (CONF-800235—).

From ASM/SAMPE conference on specialized cleaning, finishing and coating processes; Los Angeles, CA, USA (5 Feb 1980).

A separate abstract was prepared for one paper in these proceedings. One other paper, entitled Advanced Electron Beam Techniques for Metallic and Ceramic Protective Coating Systems, has been put in the EDB earlier. Twenty-three papers that were not abstracted cover various aspects of new developments in coating technology, prebond surface treatments, surface preparation for metal joining, surface finishing, and the attraction to industry of inorganic coatings. (LEW)

31882 **Vacuum deposited selective absorber coatings for solar receivers.** Thornton, J.A. (Telic Corporation, Santa Monica, CA). pp 317-331 of Specialized cleaning, finishing and coating processes. Metals Park, OH; American Society for Metals (1981).

From ASM/SAMPE conference on specialized cleaning, finishing and coating processes; Los Angeles, CA, USA (5 Feb 1980).

The physical requirements for selective absorber coatings are summarized. Vacuum deposition methods, particularly sputtering, are described, and examples are given which illustrate ways by which the basic coating configuration for selective absorbers has been implemented. (LEW)

1420 Heat Storage

REFER ALSO TO CITATION(S) 32085

31883 (SAND—81-1868C) Single media thermocline TES studies at Sandia National Laboratories. Gross, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 7p. (CONF-810940—1). NTIS, PC A02/MF A01. Order Number DE81028001.

From Annual meeting on thermal and chemical storage; Tysons Corner, VA, USA (16 Sep 1981).

The status of thermocline thermal energy storage (TES) development at Sandia National Laboratories is summarized. The work centers around testing in the 1200 gal engineering prototype thermocline test facility. The results of heat loss, charge, discharge and static tests in the prototype tank are described. Also described are analytical work and a supportive laboratory-scale program which is investigating diffusers to inhibit mixing in the tank.

15 GEOTHERMAL ENERGY

31884 (LBL—12820) GRAD: a tool for program analysis and progress monitoring. Yen, W.W.S.; Lawrence, J.D. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 5p. (CONF-811015—14). NTIS, PC A02/MF A01. Order Number DE81028098.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

Information required for development, monitoring, and evaluation of Federal geothermal programs is extensive, and is needed on a timely basis to optimize the allocation of resources. This paper describes the development and operation of the Geothermal Resource Areas Database (GRAD). GRAD was created as part of the National Geothermal Progress Monitor System in 1979. The database is organized around the concept of a geothermal area and provides broad coverage of geothermal development activities in the United States. Sixteen records, covering pre-lease, lease, and post-lease activities have been defined for each area. Data collected in the various subject areas are critically evaluated, and then entered into an on-line interactive computer system. The system is publicly available for retrieval and use.

1501 Resource Status And Assessment

31885 (DOE/ET/28465—T1) Evaluation of potential geopressure geothermal test sites in southern Louisiana. Bassiouni, Z. (Louisiana State Univ., Baton Rouge (USA). Dept. of Petroleum Engineering). Apr 1980. Contract AS05-76ET28465. 180p. NTIS, PC A09/MF A01. Order Number DE81028753.

Six geopressured-geothermal prospects in southern Louisiana were studied in detail to assess their potential use as test sites for the production of geopressure-geothermal energy. Each of the six sites contains substantial quantities of energy. Three of these prospects, Grand Lake, Lake Theriot, and Bayou Hebert, appear to be suitable for a test site. A summary of the findings is presented.

1502 Geology And Hydrology Of Geothermal Systems

31886 (CONF-811021—1) Shale mineralogy and burial diagenesis of Frio and Vicksburg Formations in two geopressured wells, McAllen Ranch area, Hidalgo County, Texas. Freed, R.L. (Trinity Univ., San Antonio, TX (USA)). 1981. Contract AC08-79ET27111. 17p. NTIS, PC A02/MF A01. Order Number DE81026014.

From 31. annual meeting of the Gulf Coast Association of Geological Societies; Corpus Christi, TX, USA (21 Oct 1981).

Thirty-six shale samples ranging in depth from 1454 ft to 13,430 ft from Shell Oil Company No. 1 Dixie Mortgage Loan well and 33 shale samples ranging in depth from 2183 ft to 13,632 ft from Shell Oil/Delhi-Taylor Oil Corporation No. 3 A.A. McAllen well were examined by x-ray techniques to determine the mineralogical parameters of the geopressured zone in the Vicksburg Fairway. Both wells have the same weight-percent trends with depth for the mineralogy: quartz, calcite, total clay, and potassium feldspar are constant; plagioclase feldspar gradually increases; kaolinite increases; discrete illite decreases; total mixed-layer illite-smectite (I/S) decreases; illite in mixed-layer I/S increases; and smectite in mixed-layer I/S decreases. Chlorite is found only in the geopressured zone of each well.

31887 (CONF-811026—9) Structural evolution of three geopressured-geothermal areas in the Texas Gulf Coast. Winker, C.D.; Morton, R.A.; Garcia, D.D. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1981. Contract AC08-79ET27111. 13p. NTIS, PC A02/MF A01. Order Number DE81029799.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

Detailed analysis of geological and seismic data from several geopressured geothermal areas (Cuero, Blessing, Pleasant Bayou) reveals similarities in structural-stratigraphic relationships that form geopressured aquifers as well as differences in structural complexity and evolution that characterize the different areas. In these examples, geopressured sandstones are isolated on the updip side by downfaulting against shelf-slope shales, and on the downdip side by upfaulting against transgressive marine shales. Moreover, they are isolated above and below by thick sequences of transgressive shale or interbedded sandstone and shale. Prospective reservoirs are found where delatic and associated sandstones (distributary channel, delta front, barrie-strandplain) were deposited seaward of major growth faults and near the shelf margin. Structural development in these areas began with rapid movement of relatively straight to sinuous down-to-the basin growth faults with narrow to wide spacings and varying amounts of rollover. Later structural movement was characterized by continued but slower movement of most growth faults. In the Pleasant Bayou area, late salt diapirism superimposed a dome-and-withdrawal-basin pattern on the earlier growth-fault style.

31888 (CONF-811026—10) Geometry and reservoir heterogeneity of tertiary sandstones: a guide to reservoir continuity and geothermal resource development. Morton, R.A.; Ewing, T.E. (Texas Univ., Austin (USA). Bureau of Economic Geology). 1981. Contract AC08-79ET27111. 16p. NTIS, PC A02/MF A01. Order Number DE81029782.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

External and internal continuity of Tertiary sandstones are controlled by various factors including structural trends, sand body geometry, and the distribution of mineral framework, matrix, and intersticies within the sand body. Except for the limits imposed by faults, these factors are largely inherited from the depositional environment and modified during sandstone compaction and cementation. Sandstone continuity affects energy exploration and production strategies. The strategies range in scope from regional to site-specific and closely parallel a sandstone hierarchy. The hierarchy includes subdivisions ranking from genetically related aquifer systems down to individual reservoirs within a fault-bounded sandstone. Volumes of individual reservoirs are 50% less to 200% more than estimated from conventional geologic mapping. In general, mapped volumes under-estimate actual volumes where faults are nonsealing and overestimate actual volumes where laterally continuous shale breaks cause reductions in porosity and permeability. Gross variations in these pore properties can be predicted on the basis of internal stratification and sandstone facies. Preliminary analyses indicate that large aquifers are found where barrier and strandplain sandstones parallel regional faults or where fluvial (meandering) channels trend normal to regional faults. Within these sand bodies, porosity and permeability are highest in large-scale cross-bedded intervals and lowest in contorted, bioturbated, and small-scale ripple cross-laminated intervals.

31889 (LA—8923-MS) Geology and geochemistry of samples from Los Alamos National Laboratory HDR Well EE-2, Fenton Hill, New Mexico. Laney, R.; Laughlin, A.W.; Aldrich, M.J. Jr. (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 33p. NTIS, PC A03/MF A01. Order Number DE81026068.

Petrologic, geochemical, and structural analyses of cores and cuttings obtained from 3000 to 4389-m true vertical depth in drill hole EE-2 indicate that this deeper part of the Precambrian section at Fenton Hill, New Mexico is composed primarily of a very heterogeneous and structurally anisotropic metamorphic complex, locally intruded by dikes and sills of granodioritic and monzogranitic composition. In this borehole none of these igneous bodies approach in size the 335-m-thick biotite-granodiorite body encountered at 2591-m depth beneath Fenton Hill in the other two drill holes. Contacts between the igneous and metamorphic rocks range from sharp and discordant to gradational. Analysis of cuttings indicates that clay-rich alteration zones are relatively common in the openhole portion of EE-2. These zones average about 20 m in thickness. Fracture sets in the Precambrian basement rock intersected by the EE-2 well bore mostly trend northeast and are steeply dipping to vertical; however, one of the sets dips gently to the northwest. Slickensided fault planes are present in a core (No.5) taken from a true vertical depth of 4195 m. Available core orientation data and geologic inference suggest that the faults dip steeply and trend between N.42° and 59°E.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 31649, 31889, 31906, 32453

31890 (LA—8598-MS) Case history on geothermal-well-log interpretation: Surprise Valley, California. Rigby, F.A.; Zebal, G.P. (Los Alamos Scientific Lab., NM (USA)). Jun 1981. Contract W-7405-ENG-36. 63p. NTIS, PC E03/MF A01. Order Number DE81028544.

Well logs from a 1972 geothermal well drilled in California's Surprise Valley are discussed. The well is in an igneous formation, primarily basalt in the logged interval, and had a bottom-hole temperature of about 170°C at a total depth exceeding 1400 m. It produced good flow rates from what is presumably a formation with predominately fracture-related permeability. The well has special interest because fractures could be located approximately by the appearance of well-defined secondary crystallization in the drill cuttings. The original use of the log data in evaluating the well when it was drilled is discussed. In addition, the log data are reviewed and valuable data are obtained on log response in basalts, the effects of secondary mineralization, fracture detection, and aspects of the resistivity logs. The Surprise Valley well gives a clear demonstration of the value of thorough logging in geothermal exploratory wells, especially in the identification and location of potential production zones.

31891 (LA-UR—81-1806) Schlumberger resistivity study of the Jemez Springs region of northwestern New Mexico. Pearson, C.; Goff, F. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-811015—10). NTIS, PC A02/MF A01. Order Number DE81025302.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

The results of 33 Schlumberger resistivity soundings made in the Jemez Mountains of northwestern New Mexico, near the village of Jemez Springs, are presented. Three areas that have potential as low-temperature geothermal reservoirs were identified using these data. The areas are characterized by a localized zone of very low resistivity ($< 10\ \Omega m$), which represents the extent of geothermal water and correlates with the location of hot springs or recent volcanic rocks. Resistivities increase rapidly toward the margins of the anomalies, which suggests either variable porosities or variable temperatures and salinities in the reservoirs.

31892 (LA-UR—81-1956) Wireline well logging an underutilized technique in reservoir evaluation. Mathews, M. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-811015—9). NTIS, PC A02/MF A01. Order Number DE81025358.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

Wireline well logs have three general uses in geothermal exploration and reservoir evaluation: reservoir parameter analysis, lithologic column determination, and reservoir size resolution. Reservoir flow testing data are acquired to understand the flow rate, life, and production potential of the geothermal reservoir. These data are a coarse subsurface measurement of the geothermal prospect. Wireline logs acquired from wells in a geothermal prospect are used to define in detail, or estimate the reservoir parameters of temperature, thickness, lateral size, amount of fracture and intergranular pore space, and the quantity and quality of fluid that might be produced. Laboratory measurements can be made on core samples and drill cuttings samples to define the intrinsic behavior of the materials and fluid that compose the geotheraml reservoir. Wireline log measurements are needed to correlate and link the reservoir testing and core analysis, reduce the amount of time needed for flow testing, and predict the production life (amount of heat and fluid available) in a geothermal field.

31893 (PB—81-130759) Gas saturation in formation waters. Annual report, Mar 79-80. Randolph, P.L.; Rockar, E.M.; Osif, T.L. (Institute of Gas Technology, Chicago, IL (USA)). May 1980. Contract GRI-5011-321-0140. 84p. NTIS, PC A05/MF A01.

The purpose of this program is to increase our knowledge of the chemistry of formation waters from geopressured-geothermal reservoirs. A program of down-hole sampling, chemical analysis, and thermodynamic reconstruction was carried out.

31894 (SAND—81-1020) Geothermal Drilling and Completion Technology Development Program. Quarterly progress report, January 1981-March 1981. Kelsey, J.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Jun 1981. Contract AC04-76DP00789. 250p. NTIS, PC A11/MF A01. Order Number DE81029292.

The progress, status, and results of ongoing Research and Development (R and D) within the Geothermal Drilling and Completion Technology Development Program are described. The program emphasizes the development of geothermal drilling hardware, drilling fluids, completion technology, and lost circulation control methods as they apply to advanced drilling systems.

31895 (SAND—81-1384C) Accessing the geothermal resource. Kelsey, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 6p. (CONF-811018—1). NTIS, PC A02/MF A01. Order Number DE81025396.

From Showcase for technology conference; Albuquerque, NM, USA (28 Oct 1981).

The technology development efforts ongoing at Sandia National Laboratories in the areas of drilling, completion, and logging instrumentation are described. These development efforts are aimed at solving the problems associated with the high temperatures, hard-fractured geological formations, and corrosive formation fluids.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 31898, 31907, 31908, 31915

1506 Environmental Aspects And Waste Disposal

31896 (DOE/ET/27039—T1) Use of geothermal heat for sugar refining in Imperial County. Final environmental report. (TRW, Inc., Redondo Beach, CA (USA)). Oct 1979. Contract AC03-79ET27039. 212p. NTIS, PC A10/MF A01. Order Number DE81027035.

The following aspects of the existing site environment are discussed: geology, hydrology, climatology, soils, air quality, noise,

biology, archaeology, land use, and socioeconomics and demography. Also included are: the project description, environmental impacts and mitigation measures, unavoidable adverse impacts, reclamation and restoration, alternatives to the proposed project, irreversible and irretrievable commitments of resources, and regulatory compliance. (MHR)

31897 (EGG—2119) Raft River geothermal project groundwater monitoring program. Progress report. Skiba, P.; Goldman, D.; Spencer, S.; Hull, L. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1981. Contract AC07-76ID01570. 42p. NTIS, PC A03/MF A01. Order Number DE81030202.

The Raft River 5 MWe geothermal power plant will use 150 L/s of geothermal fluid at 140°C, and an estimated 130 L/s will be discharged to intermediate-depth injection wells during normal plant operation. A monitoring program has been established to investigate the effects of geothermal fluid disposal on shallow irrigation wells at Raft River. This annual progress report summarizes data collected from seven monitor wells during 1980 (including the first quarter of FY 1981) and discusses the potential effects on shallow aquifers of the production and injection of geothermal fluids.

31898 (PNL—2991) Cost of meeting geothermal liquid effluent disposal regulations. Wells, K.D.; Currie, J.W.; Price, B.A.; Rogers, E.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 107p. NTIS, PC A06/MF A01. Order Number DE81030311.

Background information is presented on the characteristics of liquid wastes and the available disposal options. Regulations that may directly or indirectly influence liquid waste disposal are reviewed. An assessment of the available wastewater-treatment systems is provided. A case study of expected liquid-waste-treatment and disposal costs is summarized. (MHR)

31899 (PNL—3847) Updated cost estimates of meeting geothermal hydrogen sulfide emission regulations. Wells, K.D.; Currie, J.W.; Weakley, S.A.; Ballinger, M.Y. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Aug 1981. Contract AC06-76RL01830. 72p. NTIS, PC A04/MF A01. Order Number DE81028359.

A means of estimating the cost of hydrogen sulfide (H_2S) emission control was investigated. This study was designed to derive H_2S emission abatement cost functions and illustrate the cost of H_2S emission abatement at a hydrothermal site. Four tasks were undertaken: document the release of H_2S associated with geothermal development; review H_2S environmental standards; develop functional relationships that may be used to estimate the most cose-effective available H_2S abatement process; and use the cost functions to generate abatement cost estimates for a specific site. The conclusions and recommendations derived from the research are presented. The definition of the term impacts as used in this research is discussed and current estimates of the highest expected H_2S concentrations of in geothermal reservoirs are provided. Regulations governing H_2S emissions are reviewed and a review of H_2S control technology and a summary of the control cost functions are included. A case study is presented to illustrate H_2S abatement costs at the Baca KGRA in New Mexico.

31900 (UCRL—86547) Assessment of the injectability of brines produced by geopressured-geothermal resources of the Gulf Coast. Harrar, J.E.; Netherton, R.; Locke, F.E.; Owen, L.B. (Lawrence Livermore National Lab., CA (USA); Terra Tek, Inc., Salt Lake City, UT (USA)). Aug 1981. Contract W-7405-ENG-48. 5p. (CONF-811026—3). NTIS, PC A02/MF A01. Order Number DE81028159.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

A mobile, field test system has been developed for on-line evaluation of geopressured brine injectability at elevated pressures and temperatures. The apparatus consists of a flow system that is connected directly to the well-site brine-handling equipment. The system permits injectability assessment on the basis of standard membrane filtration tests and an examination of the effects of brine aging by means of incubation tests. Auxiliary instrumentation is used to characterize the brine suspended solids. The test system is being used to diagnose water quality at the design wells.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 31897, 32109

1509 Geothermal Engineering

31901 (DOE/ER/02534—7) Seismological investigation of crack formation in hydraulic rock fracturing experiments and in natural geothermal environments. Progress report, September 1, 1980-August 31, 1981. Aki, K. (Massachusetts Inst. of Tech., Cambridge (USA)). Sep 1981. Contract AS02-76ER02534. 47p. (COO—2534-7). NTIS, PC A03/MF A01. Order Number DE81030045.

Progress is reported on the following: interpretation of seismic data from hydraulic fracturing experiments at the Fenton Hill Hot Dry Rock Geothermal Site, interpretation of 3-D velocity anomalies in the western US with special attention to geothermal areas, theoretical and observational studies of scattering and attenuation of high-frequency seismic waves, theoretical and observational studies of volcanic tremors in relation to magma transport mechanisms, and deployment and maintenance of 9 event-recorders around Mt. St. Helens. Abstracts of papers submitted for publication are included. (MHR)

31902 (DOE/ET/27081—T1) Overview of drilling and completion practices in geopressured-geothermal wells. Eaton, B.A. (Eaton Industries of Houston, Inc., TX (USA)). 1981. Contract AC08-80ET27081. 6p. (CONF-811026—4). NTIS, PC A02/MF A01. Order Number DE81029131.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

Experience in the DOE's Wells of Opportunity program, drilling and testing geopressured-geothermal reservoirs is reviewed and some conclusions concerning drilling and completion practices, ways to cut operating costs for these tests, and long-term production applications are presented.

31903 (LA-UR—81-1769) Radioactive tracers used to characterize geothermal reservoirs. Dennis, B.R.; Potter, R.; Kolar, J. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-811015—5). NTIS, PC A02/MF A01. Order Number DE81025372.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

Data obtained from Br^{82} tracer injections with downhole gamma ray monitoring were used to quantify flow fractions entering and leaving the GT-2B and EE-1 reservoirs at various depths. The Br^{82} tracer method also provided data needed to characterize changes in the reservoir volume and flow distribution within fracture system during the recent 281 day sustained heat extraction experiment at the Hot Dry Rock Fenton Hill Site.

31904 (LA-UR—81-1783) Some results of a long-term flow test of a hot-dry-rock reservoir. Zyvoloski, G.A.; Aamodt, R.L.; Fisher, H.N.; Murphy, H.D. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 5p. (CONF-811015—11). NTIS, PC A02/MF A01. Order Number DE81025298.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

Results from a 286-day flow test of a new hot dry rock reservoir created at Fenton Hill in the Jemez Mountains in northwest New Mexico are presented. The reservoir was created by fracturing an interval of granitic rock at a depth of 2.93 km (9620 ft). The system was formed from a recemented wellbore pair used to create the first hot dry rock reservoir. The undisturbed rock temperature at the bottom of the new reservoir was 197°C. With a nominal outlet flow of 5.7×10^{-3} m³/s (95 gpm), the reservoir showed a thermal drawdown of about 8°C. A preliminary estimate of the heat transfer area is 45,000 m² (480,000 ft²). The water loss rate to the formation was 4.6×10^{-4} m³/s (7 gpm). The flow impedance was 1.6 GPa s/M³ (15 psi/gpm). The results of the flow test show that in comparison with the earlier smaller hot dry rock system at the same site, the large increase in heat transfer area was accompanied by only a small increase in the water loss and with the impedance staying essentially constant.

31905 **(LA-UR—81-1786) Sidetracking experiences in hot granitic wellbores.** Pettitt, R.A.; Carden, R. (Los Alamos National Lab., NM (USA); Grace, Sursen, Moore and Associates, Amarillo, TX (USA)). 1981. Contract W-7405-ENG-36. 3p. (CONF-811015—12). NTIS, PC A02/MF A01. Order Number DE81025299.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

In the development of the first Hot Dry Rock (HDR) geothermal energy extraction system at Fenton Hill, west of Los Alamos, New Mexico, man-made reservoirs were created by connecting two holes in hot, impermeable crystalline rock with hydraulically-produced fractures. This system consists of two near-vertical, 24.5-cm (9-5/8-in.) diameter holes approximately 3 km (10,000 ft) deep in Precambrian basement rock, at a bottom-hole temperature of 200°C (400°F). In order to improve the connection between the wellbores, the production hole was sidetracked to intercept the fracture zone at a more favorable depth. Two successful sidetrack operations were accomplished in 1977, utilizing cement plugs, underreaming, Dyna-Drills, and both button and diamond bits. Drilling of the second larger, commercial-sized reservoir system began in 1979 and consists of two boreholes drilled to a depth of 4 km (15,000 ft) at an angle of 35° from the vertical, which will be connected by a series of hydraulic fractures extending across the 400-m-(1200-ft) vertical separation of the two holes. Sidetracking to bypass a stuck bottom-hole assembly was accomplished through the use of a whipstock device, Dyna-Drills, and button bits. This paper is presented as a case history of the efforts involved to achieve successful sidetracking in hot granitic wellbores.

31906 **(SAND—81-1342C) Acoustic cement bond logging diagnostics for geothermal applications.** Chang, H.T. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. (CONF-811015—1). NTIS, PC A02/MF A01. Order Number DE81023302.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

For the successful and safe operation of a geothermal well, casing and cement conditions must be accurately determined. Cement bond logs are needed to detect channels or water pockets in the cement between the pipe and the formation and to determine the condition of the cement bond to the pipe and to the formation. Instrumentation for making such measurements is limited by the temperature capabilities (< 175°C) of existing logging equipment which was developed for the oil and gas industry. This paper reviews an acoustic system of the type that is needed for geothermal cementing inspection, identifies the principle deficiencies in its high temperature use, and describes Sandia's R & D project for developing high temperature acoustic cement bond logging diagnostics.

31907 **(SAND—81-1462C) Well descriptions for geothermal drilling.** Carson, C.C.; Livesay, B.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 20p. (CONF-811015—2). NTIS, PC A02/MF A01. Order Number DE81023743.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

Generic well models have been constructed for eight major geothermal resource areas. The models define representative times and costs associated with the individual operations that can be expected during drilling and completion of geothermal wells. They were made for and have been used to evaluate the impacts of potential new technologies. Their nature, their construction, and their validation are discussed.

31908 **(SAND—81-1470C) Impact of bit performance on geothermal-well cost.** Lin, Y.T. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-811015—6). NTIS, PC A02/MF A01. Order Number DE81023652.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

The impacts of technological improvements in drill bits on geothermal well costs are evaluated using a compilation of well costs associated with conventional drilling technology. The compilation centers around well models that have been constructed for the major US geothermal areas. Parametric analyses showing the relative importance of the bit performance parameters in well cost reduction and the results of analyses of specific new bit technologies are presented. These results have been used to evaluate the benefits of new technologies and to direct their development.

31909 **(SAND—81-1490C) Sandia program in geothermal technology development.** Kelsey, J.R.; Caskey, B.C. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-811015—4). NTIS, PC A02/MF A01. Order Number DE81025394.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

The objective of the Department of Energy (DOE) sponsored program in geothermal research and development (R and D) has shifted from demonstrating technologies for well cost reduction to long range R and D aimed at developing advanced technologies. This paper presents the accomplishments of the program, the status of current projects, and plans for future activities. The program includes R and D in high temperature rock penetration mechanics, drilling fluids borehole mechanics, and diagnostics technology.

31910 **(SAND—81-1502C) Balanced-pressure techniques applied to geothermal drilling.** Dareing, D.W.; Kelsey, J.R. (Sandia National Labs., Albuquerque, NM (USA); Maurer Engineering, Inc., Houston, TX (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-811015—3). NTIS, PC A02/MF A01. Order Number DE81023762.

From Geothermal Resources Council annual meeting; Houston, TX, USA (25 Oct 1981).

Geothermal drilling often takes place in high surface relief areas where ground water tables are a considerable distance (~ 1000 ft) below rig level. Above the water table, the formation pressure gradient is zero, and below the water table, the formation pressure increases with depth. Pressure unbalance between wellbore drilling fluid and formation pressures exists from spud-in and drives drilling fluid into the formation when voids are encountered at the drill bit. When this happens, drilling fluid does not return to the rig because it is pumped into these voids and thus circulation of the drilling fluid is lost. Lost circulation is generally controlled by two techniques: (1) sealing formations so that drilling fluid will not flow into them; and (2) reducing drilling fluid pressure in the wellbore so that it essentially balances formation fluid pressure. This paper deals with the second control technique, describing four balanced pressure drilling techniques and giving advantages and disadvantages of each.

31911 **(SAND—81-1634C) Investigation of percussion drills for geothermal applications.** Finger, J.T. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 21p. (CONF-811023—1). NTIS, PC A02/MF A01. Order Number DE81026000.

From 1981 SPE annual technical conference and exhibition; San Antonio, TX, USA (4 Oct 1981).

A series of tests was conducted to provide data for an economic evaluation of percussion drilling in geothermal reservoirs. Penetration rate, operation on aqueous foam, and high temperature vulnerabilities of downhole percussion tools are described.

31912 **(SAND—81-7128) Temperature histories in geothermal wells: survey of rock thermomechanical properties and drilling, production, and injection case studies.** Goodman, M.A. (Sandia National Labs., Albuquerque, NM (USA); Enertech Engineering and Research Co., Houston, TX (USA)). Jul 1981. Contract AC04-76DP00789. 86p. NTIS, PC A05/MF A01. Order Number DE81029957.

Thermal and mechanical properties for geothermal formations are tabulated for a range of temperatures and stress conditions. Data was obtained from the technical literature and direct contacts with industry. Thermal properties include heat capacity, conductivity, and diffusivity. Undisturbed geothermal profiles are also presented. Mechanical properties include Youngs modulus and Poisson ratio. GEOTEMP thermal simulations of drilling, production and injection are reported for two geothermal regions, the hot dry rock area near Los Alamos and the East Mesa field in the Imperial Valley. Actual drilling, production, and injection histories are

simulated. Results are documented in the form of printed GEOTEMP output and plots of temperatures versus depth, radius, and time. Discussion and interpretation of the results are presented for drilling and well completion design to determine: wellbore temperatures during drilling as a function of depth; bit temperatures over the drilling history; cement temperatures from setting to the end of drilling; and casing and formation temperatures during drilling, production, and injection.

1510 Direct Energy Utilization

31913 **(DOE/ET/27039—T2) Use of geothermal heat for sugar refining in Imperial County. Final report, Phase I.** (TRW Systems and Energy, Redondo Beach, CA (USA)). Dec 1980. Contract AC03-79ET27039. 32p. NTIS, PC A03/MF A01. Order Number DE81028967.

The objective of the three-phase Holly Sugar Geothermal Project was to replace fossil fuels with geothermal energy for sugar beet processing at the Holly Sugar plant located in Brawley, California, in a technically straightforward, economically sound and environmentally acceptable manner. The first phase of the project, discussed in this final report, encompassed the design and analysis of a geothermal industrial heat system for Holly Sugar and addresses: (1) assessment of the geothermal resource; (2) development of a preliminary system design; (3) analysis and publication of an environmental analysis and monitoring report; (4) preliminary economic analyses; (5) dissemination of project related information; and (6) the development of a proposal for the follow-on phases.

31914 **(DOE/ET/27229—T1) Feasibility analysis of geothermal district heating for Lakeview, Oregon.** (Northwest Geothermal Corp., Portland, OR (USA); Coury and Associates, Denver, CO (USA)). 23 Dec 1980. Contract AC51-79ET27229. 93p. NTIS, PC A05/MF A01.

An analysis of the geothermal resource at Lakeview, Oregon, indicates that a substantial resource exists in the area capable of supporting extensive residential, commercial and industrial heat loads. Good resource productivity is expected with water temperatures of 200°F at depths of 600 to 3000 feet in the immediate vicinity of the town. Preliminary district heating system designs were developed for a Base Case serving 1170 homes, 119 commercial and municipal buildings, and a new alcohol fuel production facility; a second design was prepared for a downtown Mini-district case with 50 commercial users and the alcohol plant. Capital and operating costs were determined for both cases. Initial development of the Lakeview system has involved conducting user surveys, well tests, determinations of institutional requirements, system designs, and project feasibility analyses. A preferred approach for development will be to establish the downtown Mini-district and, as experience and acceptance are obtained, to expand the system to other areas of town. Projected energy costs for the Mini-district are $10.30 per million Btu while those for the larger Base Case design are $8.20 per million Btu. These costs are competitive with costs for existing sources of energy in the Lakeview area.

31915 **(DOE/ET/28447—T1) Multi-use geothermal-energy system with augmentation for enhanced utilization: a non-electric application of geothermal energy in Susanville, California. Final report.** Olson, G.K.; Benner-Drury, D.L.; Cunnington, G.R. (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Feb 1979. Contract AC03-78ET28447. 200p. NTIS, PC A09/MF A01.

A site specific engineering and economic study of multi-use, augmented geothermal space/water heating and cooling systems was completed. The overall benefits to the City of Susanville, in both the public and private sectors, of using low temperature (150°F to 240°F) geothermal resources are explored. Options considered, alone and in combination, include heat pumps, fossil-fuel peaking, user load balancing, and cascading from the geothermal system serving the public buildings into a private Park of Commerce development. A range of well temperatures, depths, flow rates, and drilling costs are considered to provide system cost sensitivities and to make the study more widely useful to other sites. A planned development is emphasized for ease of financing of expansion. A preliminary design of Phase A of a Susanville Public Building Energy System and a conceptual design of an integrated Park of Commerce, Phase I, are included. This system was designed for a 150°F resource and can be used as a model for other communities with similar resource temperatures.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 31888, 32628

31916 **(CONF-811026—7) Predicting diagenetic history and reservoir quality in the Frio Formation of Brazoria County, Texas and Pleasant Bayou test wells.** Kaiser, W.R.; Richmann, D.L. (Texas Univ., Austin (USA). Bureau of Economic Geology; Radian Corp., Austin, TX (USA)). 1981. Contract AC08-79ET27111. 23p. NTIS, PC A02/MF A01. Order Number DE81029771.

From 5. geopressured-geothermal energy conference; Baton Rouge, LA, USA (13 Oct 1981).

Good-quality geothermal reservoirs displaying secondary porosity exist on the upper Texas coast (Brazoria County), site of the Pleasant Bayou No. 1 and No. 2 wells, and are attributed to a moderately stable mineral assemblage, normal geothermal gradients, and low in situ pH. Major authigenic minerals are calcite, quartz, and kaolinite. Detrital feldspar has been extensively albitized at depth. Major diagenetic events overlapped, occurring in the general order-precipitation of calcite, formation of quartz overgrowths, albitization, leaching of calcite to form secondary porosity, and precipitation of kaolinite. Seventeen Brazoria County water analyses including two from the Pleasant Bayou No. 2 well were thermodynamically tested. Predictions based on equilibrium thermodynamics add new insight on mineral stabilities and are consistent with the paragenetic sequence developed from petrographic data. Early precipitation of calcite at shallow depths of burial is predicted. Low temperture and low in situ pH explain the general absence of chlorite. The use of solution-mineral equilibria as a predictor of reservoir quality is inconclusive, but well-defined clustering of waters indicates that identification of regional trends will probably be possible. Shallow waters may be the key to predicting reservoir quality at depth.

31917 **(LBL—12810) Technical databook for geothermal energy utilization.** Phillips, S.L.; Igbene, A.; Fair, J.A.; Ozbek, H.; Tavana, M. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01. Order Number DE81029868.

A critical survey is made of selected basic data on those aqueous solutions needed to model geothermal energy utilization. The data are useful in the design and construction of power plants and for direct use. The result of the survey is given as a current status of data. More emphasis is placed on the viscosity, thermal conductivity and density of sodium chloride solutions up to 350°C and 50 MPa. An ideal data book for geothermal energy is described.

16 Tidal Power

REFER ALSO TO CITATION(S) 31801

17 WIND ENERGY

REFER ALSO TO CITATION(S) 31801

1704 Economics

REFER ALSO TO CITATION(S) 31920

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 32153

31918 **(NP—1904016) Water-pumping-windmill designs: a handbook.** (Tata Energy Research Inst., Bombay (India)). Jun 1981. 162p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE81904016.

Windmills are becoming an attractive proposition for water pumping in the rural areas. Recently, there has been an increasing demand for information on designs of water pumping windmills which could be constructed with inexpensive and locally available materials and skills. This handbook is intended to meet the above demand and it covers about 23 indigenous windmill designs and information such as Name of the Designer, Institutional Affiliation, Type of Windmill, Specific Applications and Suitability, Design Features (Rotor Assembly, Sails/Blades, Power Transmission, Tower Structure, Tail Assembly, Pump etc.), and Operating Data wherever available. Most of these designs have been tested and have successfully been used in different parts of the world. Few of the designs are patented but design drawings and further technical information are likely to be available free from the designers. Commercially obtainable windmills have also been listed along with complete address of the manufacturers and relevant technical specifications.

31919 **(SERI/TR—8085-3-T1) Yawing of wind turbines with blade cyclic pitch variation.** Hohenemser, K.H.; Swift, A.H.; Peters, D.A. (Solar Energy Research Inst., Golden, CO (USA); Washington Univ. Technology Associates, Inc., St. Louis, MO (USA)). Aug 1981. Contract AC02-77CH00178. 15p. NTIS, PC A02/MF A01. Order Number DE81030091.

The purpose of this study was to determine by analysis, model tests, and full-scale experiments whether a two-bladed wind rotor with passive cyclic pitch variation, yawed for the purpose of rotor speed and torque control, has the potential of cost-effective wind energy conversion. A simple mechanism adopted from rotorcraft technology for obtaining passive cyclic pitch variation makes rapid yaw rates possible without causing vibratory hub moments and without producing appreciable out-of-plane blade excursions. A 7.6-m diameter vane-stabilized fully instrumented wind rotor having low blade solidity was operated between May and October 1980, during 41 days for 96 hours. The operational envelope extended to 16m/sec wind velocity, to 45-degree yaw angle power-on and 80-degree yaw angle power-off. The rotor was automatically yawed when 228 rpm at 10-kW rotor power was exceeded. Reverse yawing was performed manually. Within the tested performance envelope, loads and vibrations were low. The rotor ran smoothly even at high yaw angles and at high yaw rates. Performance was good.

31920 **Large wind turbine development.** Kennard, J.G. (NASA, Cleveland, OH). pp 119-143 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The current NASA-US DOE large-scale wind turbine development program is described. Achievements are reviewed and future plans are outlined. Projected power generation costs are presented.

31921 **(DOE/SF/01959—T1) Wind energy education projects. Final report.** Ziegler, P.; Conlon, T.R.; Arcadi, T.; Burke, R. (Aeropower, Berkeley, CA (USA); Earth Lab Inst., Berkeley, CA (USA); Vallejo City Schools, CA (USA)). [nd]. Contract FG03-78SF01959;FG03-78SF02013. 90p. NTIS, PC A05/MF A01. Order Number DE81027810.

Two projects under DOE's Small-Scale Appropriate Energy Technology Grants Program have educated the public in a hands on way about wind energy systems. The first was awarded to Peter Ziegler of Berkeley, California, to design and build a walk-through exhibition structure powered by an adjoining wind-generator. This Wind Energy Pavilion was erected at Fort Funston in the Golden Gate National Recreation Area. It currently serves both as an enclosure for batteries and a variety of monitoring instruments, and as a graphic environment where the public can learn about wind energy. The second project, entitled Wind and Kid Power, involved an educational program for a classroom of first through third grades in the Vallejo, Unified School District. The students studied weather, measured wind speeds and built small models of wind machines. They also built a weather station, and learned to use weather instruments. The grant funds enabled them to actually build and erect a Savonius wind machine at the Loma Vista Farm School.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 31795, 31852, 32079, 32081, 32123, 32124, 32126, 32127, 32130, 32131, 32150, 32436, 32550

31922 **(AD-A—089269) Cogeneration systems. Final report, July 1979-March 1980.** Cooper, E.E. (Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)). Jun 1980. 58p. NTIS, PC A04/MF A01.

Discussions are included of the four broad interrelated categories of factors to consider when evaluating candidate approaches to cogeneration at a site. The categories are technical, economic/financial, legislative/regulatory, and institutional. The inability to resolve difficulties in any area may obviate implementation of cogeneration. Generalized performance curves are presented for cogeneration systems utilizing commercially available steam turbines, diesels, or combustion turbines with heat recovery. A summary is given of federal energy and environmental legislation and regulations currently in effect which impact cogeneration systems. The nature of institutional constraints on implementing cogeneration is also discussed. The potential for cooperative ownership/operation options with utility companies or third party investors is described. The economics of cogeneration is detailed. Finally, steps are listed for proceeding through the categories of factors toward implementation of cogeneration.

31923 **(AD-A—092797) Combined cycle steam generator gas side fouling evaluation. Final report on Phase 2.** Roberts, P.B.; Kubasco, A.J. (Solar, San Diego, CA (USA)). Sep 1980. Contract N00024-77-C-4366. 35p. NTIS, PC A03/MF A01.

Liquid-fueled gas turbines can produce serious steam generator fouling in gas turbine combined cycle applications and other waste heat recovery systems as a result of combustion system generated soot particles. In addition, standard soot blowing practices are not always compatible with the advanced, compact matrix designs sometimes required for minimum package size applications. In Phase I, an experimental program was conducted on both test rigs and engine hardware designed to evaluate the effects on gas side soot fouling rates of various operational parameters such as soot loading, temperature, and velocity. Results showed that the self-cleaning concept, whereby soot deposits are removed by curtailing steam generator water flow and raising fin/tube temperatures to that of the prevailing exhaust gas, is a viable alternative to standard soot-blowing practice. The results, however, also showed inconsistencies in the self-cleaning threshold temperature between the various rigs. Phase II of this program was conducted to resolve these inconsistencies and, more specificaly, to define a cleaning schedule for a LM-2500 combined cycle. The results lend further support to the self-cleaning concept and show that at full load a LM-2500 combined cycle system would be expected to clean itself within an hour after dryout.

31924 **(DOE/ET/10340—111) Development of high-temperature turbine subsystem technology to a technology readiness status phase II.** Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Jul 1981. Contract AC01-76ET10340. 62p. NTIS, PC A04/MF A01. Order Number DE81025444.

Progress in developing a technology readiness vehicle (TRV) for demonstrating the performance of a combined-cycle power plant with high temperature (2600 to 3000°F firing temperature) gas turbines using coal-derived gas fuel is reported. Two major development tests were completed in this reporting period. In the first of these tests, the first-stage composite nozzles were successfully cycled for a total of 617 thermal cycles. In the second set of tests, the sectoral combustor was fired first on a propane/steam mixture and then on a synthetic low-Btu (LBtu) gas. The first-stage nozzles were cycled by varying combustor discharge temperature between 1000 and 2600°F. Dwell at the temperature limits was

long enough to allow the nozzles to reach steady-state. The nozzles appear to be in excellent condition after test completion. A series of tests was performed on the combustor which included: the cold and fired flow tests over the operating range, the determination of the efect of varying primary/secondary fuel flow splits, the effects of fuel composition with varying propane/steam ratios, and the determination of the minimum operating (blow out limits) map. Inspection of the second-stage nozzles after 52 thermal cycles was completed. Only minor leaks, due to casting porosity which had been noted prior to testing, were detected. X-ray photography did not indicate any cracks. Modification of the rotor water delivery and distribution test rig was completed as required in order to provide a more positive locking attachment of the water commutator shaft to the test-turbine wheel. In addition, shock tunnel tests and the update of the reference turbine subsystem design were completed. Continuing work on the combined-cycle power plant. TRV design, component development, and control system, is also reported. (LCL)

31925 **(DOE/ET/15460—193) Operation and testing of the Wormser Grate fluidized-bed combustor at the USM Corporation Facility at Beverly, Massachusetts. Final report, April 15, 1980-April 14, 1981.** Fraser, R.G. (Wormser Engineering, Inc., Middleton, MA (USA)). May 1981. Contract AC21-80ET15460. 215p. NTIS, PC A10/MF A01. Order Number DE81025835.

The Wormser Grate is a two stage fluidized bed combustor designed to retrofit industrial boilers to burn coal in an environmentally acceptable manner. A three million Btu/h. Wormser Grate was retrofitted to an old firetube boiler, and used to provide space heating for a United Shoe Corporation Plant in Beverly, Massachusetts. A one year, Department of Energy funded program was undertaken to provide valuable experience in operating an F.B.C. in an industrial setting. An instrumentation and data gathering system was assembled, and computer techniques developed to monitor F.B.C. performance. The operability of the unit was proven with 1000 h of continuous operation, and performance testing indicates that the Wormser Grate exceeds pollution regulations.

31926 **(DOE/PE/70278—T16) Financial ability of electric utilities to undertake oil-displacement programs.** Hanson, D. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Apr 1981. Contract AC01-80PE70278. 35p. NTIS, PC A03/MF A01. Order Number DE81025579.

This paper focuses on the conversion (replacement, new capacity, accelerated obsolescence) by utilities from oil and gas to coal and nuclear generating plants. In particular, current regulatory practices are discussed and whether financial barriers inhibit conversion is examined. Policy recommendations consisting of various financial incentives are suggested. It is pointed out that electric utilities use less than 10% of all domestically consumed petroleum and that the potential for a quick significant drop in total oil use is unlikely. There are substantial non-financial barriers inhibiting oil backout programs as well as financial barriers. (DMC)

31927 (EPRI-WS—80-157, pp A8.1-A8.19) **C-E/BG & E Model boiler tests.** May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31928 **(MIT-EL—79-034) Computer optimization of dry and wet/dry cooling tower systems for large fossil and nuclear power plants.** Choi, M.; Glicksman, L.R. (Massachusetts Inst. of Tech., Cambridge (USA)). Feb 1979. Contract AS02-76EV04114. 288p. NTIS, PC A13/MF A01. Order Number DE81029729.

This study determined the cost of dry cooling compared to the conventional cooling methods. Also, the savings by using wet/dry instead of all-dry cooling were determined. A total optimization was performed for power plants with dry cooling tower systems using metal-finned-tube heat exchangers and surface condensers. The optimization minimizes the power production cost. The program optimizes the design of the heat exchanger and its air and water flow rates. In the base case study, the method of replacing lost capacity assumes the use of gas turbines. As a result of using dry cooling towers in an 800 MWe fossil plant, the incremental costs with the use of high back pressure turbine and conventional turbine over all-wet cooling are 11 and 15%, respectively. For a 1200 MWe nuclear plant, these are 22 and 25%, respectively. Since the method of making up lost capacity depends on the situation of a utility, considerable effort has been placed on testing the effects of using different methods of replacing lost capacity at high ambient temperatures by purchased energy. The results indicate that the optimization is very sensitive to the method of making up lost capacity. It is, therefore, important to do an accurate representation of all possible methods of making up capacity loss when optimizating power plants with dry cooling towers. A solution for the problem of losing generation capability by a power plant due to the use of a dry cooling tower is to supplement the dry tower during the hours of peak ambient temperatures by a wet tower. A separate wet/dry cooling tower system with series tower arrangement was considered in this study, and proved to be an economic choice over all-dry cooling where some water is available but supplies are insufficient for a totally evaporative cooling tower.

31929 **(MIT-EL—79-035) Computer optimization of the MIT advanced wet/dry cooling tower concept for power plants.** Choi, M.; Glicksman, L.R. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Sep 1979. Contract AS02-76EV04114. 93p. NTIS, PC A05/MF A01. Order Number DE81029647.

Our previous study on the combination of separate dry and wet cooling towers indicated that wet-dry cooling is an economical choice over all-dry cooling when some water is available but the supply is insufficient for an evaporative tower. An advanced wet-dry cooling tower concept was experimentally studied at MIT's Heat Transfer Laboratory and a computer model was developed for predicting the performance of this cooling concept. This study has determined the cost of the cross-flow type of this cooling concept in conjunction with steam electrical power plants. Aluminum is found to be economically preferable to galvanized steel as the cooling plate material. In our base case study using aluminum plates for a 1094 MWe nuclear plant at Middletown, the MIT advanced cooling concept is comparable to conventional wet-dry towers at water makeups larger than 45% and is slightly more economical at makeup larger than 50%. The incremental costs over the power production cost, 32.3 mills/kWhr, of zero condenser system are 14, 13 and 12% for makeups of 45, 60 and 55%, respectively. For an 800 MWe fossil plant at Moline, this cooling concept is more economical than conventional wet-dry towers at water makeups larger than 27%. The incremental costs over 20.8 mills/kWhr of zero condenser system are 12.2 and 10.6% for makeups of 37 and 50%, respectively. For these two makeups, going from conventional wet-dry to MIT advanced concept results in 13 and 21%, respectively, savings in the incremental cost. When the water makeup exceeds 30%, the MIT advanced wet-dry concept is preferable to conventional wet-dry towers for a 1200 MWe nuclear plant at Moline, Ill. The incremental costs over zero condenser system of 21.1 mills/kWhr are 12.8 and 11.5% for makeups of 40 and 50%, respectively. Using the MIT advanced concept instead of conventional wet-dry towers results in 28 and 33% reduction of incremental power production cost for these two makeups, respectively.

31930 **(MIT-EL—79-037) Environmental and economic comparison of cooling-system designs for steam-electric power plants.** Najjar, K.F.; Shaw, J.J.; Adams, E.E.; Jirka, G.H.; Harleman, D.R.F. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1979. Contract AS02-76EV04114. 189p. NTIS, PC A09/MF A01. Order Number DE81029725.

The selection of waste heat rejection systems for steam-electric power plants involves a trade-off among environmental, energy and water conservation, and economic factors. This study compares four general types of cooling systems on the basis of these factors. The cooling systems chosen for study are: once-through systems including surface canals and submerged multiport diffusers; shallow closed cycle cooling ponds; mechanical and natural draft evaporative cooling towers; and mechanical draft dry towers. The cooling system comparison involves optimization of each cooling system and then a comparison among optimal systems. Comparison is made for an 800 MWe fossil unit and a 1200 MWe nuclear unit located at a river site. The results of the optimization models of each of the

systems are compared on the basis of: performance - discrete distributions of environmental conditions and transient simulation; economics - using base case scenarios and sensitivity values to arrive at costs expressed in terms of production costs, annualized costs and present value costs; energy and water consumption; and environmental effects. The once-through systems were found to be the least expensive of the four systems, the most energy efficient, but potentially the most environmentally damaging. On the other extreme, dry cooling towers are the most environmentally sound while being the most expensive and least energy efficient. Finally, the results of the economic optimization are compared with results from previous comparative studies.

31931 **(MIT-EL—79-038) Economic implications of open versus closed cycle cooling for new steam-electric power plants: a national and regional survey.** Shaw, J.J.; Adams, E.E.; Barbera, R.J.; Arntzen, B.C.; Harleman, D.R.F. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Civil Engineering). Sep 1979. Contract AS02-76EV04114. 125p. NTIS, PC A06/MF A01. Order Number DE81029730.

Current and anticipated thermal pollution regulations will prevent many new steam electric power plants from operating with once-through cooling. Alternative cooling systems acceptable from an environmental view fail to operate with the same efficiencies, in terms of resources consumed per Kwh of electricity produced, offered by once-through cooling systems. As a consequence there are clear conflicts between meeting environmental objectives and meeting minimum cost and minimum resource consumption objectives. This report examines, at both the regional and national level, the costs of satisfying environmental objectives through the existing thermal pollution regulations. This study forecasts the costs of operating those megawatts of new generating capacity to be installed between the years 1975 and 2000 which will be required to install closed cycle cooling solely to comply with thermal regulations. A regionally disaggregated approach is used in the forecasts in order to preserve as much of the anticipated inter-regional variation in future capacity growth rates and economic trends as possible. The net costs of closed cycle cooling over once-through cooling are based on comparisons of the costs of owning and operating optimal closed and open-cycle cooling configurations in separate regions, using computer codes to simulate joint power plant/cooling system operation. The expected future costs of current thermal pollution regulations are determined for the mutually exclusive - collectively exhaustive eighteen Water Resources Council Regions within the contiguous US, and are expressed in terms of additional dollar expenditures, water losses and energy consumption. These costs are then compared with the expected resource commitments associated with the normal operation of the steam electric power industry.

31932 **(MIT-EL—79-039) Mathematical Predictive Models for Cooling Ponds and Lakes. Part B. User's manual and applications of MITEMP. Part C. A transient analytical model for shallow cooling ponds.** Octavio, K.H.; Watanabe, M.; Adams, E.E.; Jirka, G.H.; Helfrich, K.R.; Harleman, D.R.F.; Koussis, A.D. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Dec 1979. Contract AS02-76EV04114. 233p. NTIS, PC A11/MF A01. Order Number DE81029705.

In Part B a computer code, MITEMP: M.I.T. Transient Temperature Prediction Model for Natural Reservoirs and Cooling Impoundments, is presented as a feasible and efficient tool for the prediction of transient performance of man-made impoundments. Particular emphasis is placed on waste heat dissipation from steam-electric power stations. The code allows the simulation of the physical regime (temperature and flow patterns) of impoundments as a function of design and for long time periods. The code contains the following elements: Natural Deep Lake and Reservoir Model; Deep Stratified Cooling Pond Model; Shallow Vertically Mixed Dispersive Cooling Pond Model; and Shallow, Vertically Mixed Recirculating Cooling Pond Model. The user's manual presented herein gives a detailed description of the computational structure of MITEMP and discusses input and output requirements. The application to several case studies is presented. A complete code listing is given in the appendix, as are some sample computations. In Part C, an analytical model is developed to predict the transient performance of shallow, vertically mixed cooling ponds. This model is suggested as an aid in the initial design or screening process, eliminating the need for repeated use of MITEMP for long term simulations. When a candidate design(s) is selected, its long term performance can be analyzed with the more precise MITEMP.

31933 **(MIT-EL—79-040) Waste-heat management in the electric-power industry: issues of energy conservation and station operation under environmental constraints.** Adams, E.E.; Harleman, D.R.F. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1979. Contract AS02-76EV04114. 69p. NTIS, PC A04/MF A01. Order Number DE81029715.

Over the past three years, the Energy Laboratory, in cooperation with the R.M. Parsons Laboratory for Water Resources and Hydrodynamics at M.I.T. has been under contract with DOE/ECT to study various water and waste heat management issues associated with the choice of cooling systems for large steam-electric power plants. The purpose of this report is to summarize the major findings to-date of this study. In addition, an introduction or background section proceeds the summary so that the results can be better integrated into the larger picture of water and waste heat management.

31934 **(ORNL/TM—7734/P2) Corrosion of high-temperature materials in AFBC environments. Part 2: 4500-h tests.** Godfrey, T.G.; DeVan, J.H. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 82p. NTIS, PC A05/MF A01. Order Number DE81028024.

Candidate heat exchanger tube materials were tested for times to 4500 h in a small atmospheric-pressure fluidized bed combustor (AFBC) operated by the FluiDyne Engineering Corporation of Minneapolis, Minnesota. The materialso included alloy 800H; types 304, 310, and 316 stainless steel; and aluminized alloy 800H and type 310 stainless steel. These air-cooled tubes were exposed to the AFBC environment with wall temperatures ranging from 820 to 875°C, a Ca/S molar ratio of 3.3 to 5.3, 2.5 to 3.5% excess O_2, and a fluidizing velocity of 0.7 m/s (2.3 fps). A set of low-temperature tubes was also included in the test for the final 3000-h period. These tubes were composites of 2-1/4 Cr-1 Mo steel and type 304 stainless steel and were air-cooled to temperatures in the range 480 to 590°C. Tubes were removed at intermediate times for metallographic examination. In general, the materials performed well. With one exception, metal wastage was at the lower limit of detection and intergranular corrosion was not severe. Most of the high-temperature samples, however, contained subsurface specks of metal sulfides, primarily of manganese, extending to depths of about 50 μm. The exception to the good performance noted above was a type 316 stainless steel high-temperature tube exposed for the final 3000-h portion of the 4500-h test. This tube suffered severe sulfidation-oxidation over most of its surface. The absence of such attack on eight other type 316 stainless steel tubes indicated that the position of the affected tube in the bed may have been a more significant corrosion factor than the steel composition per se.

31935 **(PB—81-110785) Power plant waste heat utilization in aquaculture. Volume I. Final report, 1 November 1976-1 November 1979.** Guerra, C.R.; Godfriaux, B.L.; Eble, A.F.; Farmanfarmaian, A.; Pitman, R. (Public Service Electric and Gas Co., Newark, NJ (USA). Research and Development Dept.). Mar 1980. 100p. NTIS, PC A05/MF A01.

A three-year research study on the constructive use of electric generating station waste heat in cooling water effluents for fish production is summarized. Results of the project indicate not only that it is biologically feasible to rear fresh water shrimp and rainbow trout alternately during warmer and cooler months directly in these effluents, but that it appears to be economically and technically feasible. A prototype commercial waste heat aquaculture facility for the high density culture of both finfish and shellfish is described in a subsequent proof-of-concept study. This volume presents the research objectives, approach, and product use and a technical section outlining the engineering, biological, and economic feasibility as well as product quality.

31936 **(PB—81-110793) Power plant waste heat utilization in aquaculture. Volume II. Final report, 1 November 1976-1 November 1979.** Eble, A.F. (Public Service Electric and Gas Co., Newark, NJ (USA). Research and Development Dept.). Mar 1980. 314p. NTIS, PC A14/MF A01.

A three-year research study on the constructive use of electric generating station waste heat in cooling effluents for fish production is presented. This volume specifically describes that part of the research conducted by Trenton State College. Water temperatures from the discharge canal of the Mercer Generating Station in New Jersey were blended with those from the Delaware River by pumps installed in strategic locations to achieve desired temperatures. The report further describes how recirculation is controlled during chlorination periods by activating and de-activating certain pumps. As a result of this procedure, plus an oxygen injection system, trout density was greatly increased. Techniques for growing and maintaining shrimp larvae and early juveniles in nursery systems are described. Harvest densities of the shellfish did not compare with those obtained for finfish.

31937 (PNL-SA—9780) Compressed-air energy-storage technology: program overview. Kannberg, L.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 7p. (CONF-810833—8). NTIS, PC A04/MF A01. Order Number DE81030103.

From Mechanical, magnetic, and underground energy storage 1981 annual contractors' review meeting; Washington, DC, USA (24 Aug 1981).

Energy storage is a key element in the electric utility industry strategy for shifting energy consumption from oil to coal, nuclear and renewable energy sources. The US Department of Energy (DOE) Compressed Air Energy Storage (CAES) Technology Program is directed at developing a new technology designed to reduce the consumption of oil in the generation of electric power. The program has two major elements: Reservoir Stability Studies and Second-Generation Concepts Studies. The Reservoir Stability Studies are aimed at developing stability criteria for long-term operation of large underground reservoirs used for compressed air storage. The Second-Generation Concepts Studies are aimed at developing new concepts that will require little or no petroleum fuels for operation. In this overview, the program efforts during FY-1981 are outlined and major accomplishments towards the objectives of the program are identified.

31938 Electric generation near absolute zero. Hopkinson, J.; Edmonds, J.S. *EPRI (Electric Power Research Institute) Journal ;* **6**: No. 2, 6-8, 11(Mar 1981).

Partially cooled by liquid helium, the superconducting generator is smaller, more efficient, and more resilient to variations in load than its conventional counterpart. And each attribute brings with it economic advantages. These technical attributes and their economic significance are discussed with reference to the superconducting generator which is being designed and built by the Westinghouse Electric Corp. Commercial success will depend in large measure on a long-term field test. A 300-MVA superconducting machine is scheduled for service in 1985.

31939 Energy saving in large steam turbines. Iwai, T. (Tohoku Electric Power Co. Inc., Sendai, Japan); Uenishi, A.; Aoki, I. *Energy Developments in Japan ;* **3**: No. 1, 1-23(Jul 1980).

Japan depends on imported fuels for its fossil-fuel power plants which are being built for increasingly larger capacities. Improved steam turbine efficiency can contribute to saving fuel in these plants. Therefore, studies were performed to determine where losses occurred in steam turbines at two existing power plants. Components of these turbines were then modified, redesigned and reconstructed to minimize these losses, and the reconstructed turbines were performance tested to confirm the efficacy of the changes. At the Sendai Power Plant, a turbine efficiency improvement of 4.15% was achieved which improved the plant efficiency by 1.72%. At the Niggata Power Plant No. 2 turbine efficiency was improved by 3.81% resulting in a plant efficiency improvement of 1.36%. It was concluded that energy conserving technology should be continuously applied to steam turbine systems. (LCL)

31940 Coal-water slurry systems for conversion of existing oil-fired power plants. Glenn R.D.; Rhodes, A.W.; Ehrlich, S.; Drenker, S.G. pp 195-204 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.E. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Any change from the use of oil to the use of coal for electric power generation will clearly require a major undertaking. Investment costs will be high but the savings in fuel costs will also be high. In addition, conversion will contribute to the many national objectives associated with the reduction of our dependence on foreign fuel. The use of coal-water slurries is just one of the potential means of accomplishing conversion and in order to determine its applicability and merit for each situation it must be compared with other potential options, such as: new coal-fired plant, new boiler plant, rebuilt boiler, coal-oil mixture, coal liquefaction (or solvent refined coal), or coal gasification. There will be no universally acceptable technology and the choice will be highly dependent on site specific conditions. In general, the use of slurries of either coarse or fine coal in water will merit serious consideration for units where the shipping, storing and handling of coal in bulk is impractical, uneconomical or environmentally unacceptable, but the unit is otherwise a good candidate for conversion. There are a number of such units, typically at plants which formerly burned coal but where space is now severely limited. In addition, the use of slurries of finely divided coal in water would appear to merit serious investigation for those situations where coal having a particularly low concentration of sulfur and/or ash is required. This may be obtainable economically by integrating advanced coal cleaning technology with the slurry preparation process. There are some units in this category that are located in the northern Atlantic Coast states and that formerly burned coal but are now required to use low sulfur oil. There are oil-design units located in many of the East Coast states that may be convertible to the combustion of a slurry of finely divided low-ash coal in water. However, technology for the latter requires further development and demonstration.

31941 Economic and technical criteria for coal utilization plant. Part I. Economic and financial conventions. Eriksson, S.; Forrester, R.; Johnston, R.; Teper, M. London, England; IEA Coal Research (1977). 49p. (EAS-A—1-77).

The economic and financial conventions which govern the economics of each major coal utilisation route are discussed. The economics of coal utilisation plants are examined in terms of key variables such as return-on-investment and load factor. The treatment of other economic and financial conventions such as contingencies, working capital and start-up costs is also discussed.

31942 Economic and technical criteria for coal utilization plant. Part IV. Power generation. Eriksson, S.; Forrester, R.; Johnston, R.; Teper, M. London, England; IEA Coal Research (1977). 47p. (EAS-A—4-77).

This report considers four power generation processes: conventional furnace system (with and without scrubbers), atmospheric fluidized bed and steam cycle, pressurized fluidized bed and combined cycle, and integrated gasification and combined cycle. A description of each process is given and the development status of the newer systems is reviewed. Performance data for the various processes are given including thermal efficiencies, raw material consumption and environmental instrusion. The relative advantage of new technologies over the conventional system is discussed. R and D requirements are discussed particularly indicating those critical items in process development which must be solved if the projected performance estimates are to be realised.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 31574, 31931, 32473, 32551

31943 (DOE/ET/10373—T8) Granular bed filter development program, Phase II. Quarterly report, January-March 1981. Moresco, L.L.; Ferguson, J. (Combustion Power Co., Inc., Menlo Park, CA (USA)). Aug 1981. Contract AC21-77ET10373. 90p. NTIS, PC A05/MF A01. Order Number DE81027959.

Phase I included the development of a mathematical model, a cold flow parametric test series in a 0.746 Nm^3/s GBF, and investigations of potential dust plugging problems at the inlet screen. Collection efficiencies of 99% and filter outlet loadings less than 0.0074 g/m^3 were demonstrated. The objectives of Phase II are to

investigate the effects of elevated temperature and coal combustion particulate on GBF filtration performance; to update the analytical model developed in Phase I to reflect high temperature effects; to optimize filter internal configuration; to perform parametric and long duration tests to characterize the effects of filter design improvements on filtration efficiencies. Hot flow testing to date has confirmed that the GBF configured with inlet and outlet screens has exhibited a tendency for extensive and irreversible ash plugging. The potential advantages of a screenless configuration, having higher filtration efficiency, has been confirmed. This report describes the continuation of work pertinent to the development and design improvement of the GBF system, specifically addressing: (1) the development of governing equations derived for the 3-dimensional GBF mathematical model; (2) the initial results of subcontracted experiments to establish correlations of particulate capture mechanisms for use in the numerical 3-dimensional model; and (3) the design and physical modifications incorporated into the Model 4 GBF hot test setup for the final series of hot gas tests.

31944 (PB—81-105249) Chalk Point cooling tower project native vegetation study. Final report 1979. Patterson, G.W.; Galloway, R.A.; Francis, B.A.; Lauver, T.L. (Maryland Univ., College Park (USA). Water Resources Research Center). Jun 1979. 78p. NTIS, PC A05/MF A01.

The Potomac Electric Power Company generating station at Chalk Point, MD, utilizes brackish water in its natural draft cooling tower and, consequently, releases saline aerosol into the atmosphere. A research and monitoring project was established in 1974 to evaluate the effects of this drift on native perennial vegetation. Leaf samples have been collected form dogwood, Cornys florida, Virginia pine, Pinus virginiana, black locust, Robinia pseudoacacia, and sassafras, Sassafras albidum, located at 12 different sites in the vicinity of the power plant. Sampling was begun prior to the operation of the cooling tower, 1974, and continued through 1978. Complete results from monthly monitoring of foliar chloride in the four native tree species is documented for May through September 1978. Results from salt spray experiments indicate chloride and sodium concentrations in the wood of dogwood trees increases with increased spraying levels.

31945 (PB—81-109738) Terrestrial flora and fauna in the vicinity of the Delmarva power and light station and proposed expansion site. Special report. Van Deusen, M.; Otto, R.G. (Johns Hopkins Univ., Baltimore, MD (USA). Chesapeake Bay Inst.). Apr 1980. 43p. NTIS, PC A03/MF A01.

The results of field surveys of the terrestrial vegetation, birds and mammals in the vicinity of the Delmarva Power and Light Company Vienna Steam Electric Station and proposed expansion area in Dorchester County, Maryland are presented. Four major habitats were identified: forest, oldfield, marsh and cultivated land. Qualitative surveys of flora and fauna were conducted to determine species present. Commercially important waterfowl, upland game birds and mammals and furbearers are discussed.

31946 (PB—81-110264) Zooplankton of the waters adjacent to the C. P. Crane generating station. Final report. Grant, G.C.; Womack, C.J.; Olney, J.E. (Virginia Inst. of Marine Science, Gloucester Point (USA)). Aug 1980. 147p. NTIS, PC A07/MF A01.

Zooplankton population in the Gunpowder River and its tributaries were sampled monthly from July, 1979-March, 1980 in a continuation of similar studies begun in March, 1979. The objective of the study was to determine the effect of the present once-through cooling system of the Crane Power Plant. The principal effect of the C.P. Crane generating station on zooplankton of the area is a displacement of an original freshwater community through the pumping of cooling water from Seneca Creek to Saltpeter Creek.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 32129

31947 (BNL—29932) Improved technique to measure electronically ac losses in superconducting cables. Schauer, F.; Meth, M. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810835—15). NTIS, PC A02/MF A01. Order Number DE81029323.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

An improved electronic method for measuring ac losses in superconducting cables of lengths from 1m to 10m has been developed and is described. This method compensates for phase shifts in the measuring circuit elements and for imbalance of the difference amplifier due to changes in the common mode voltage. This measuring method is being further improved and adapted to the loss measurements of the Brookhaven National Laboratory 138V, 4 kA, 100 m long superconducting cable now under construction. (LCL)

31948 (EPRI-EL—1605-Vol.1) Graphical and tabular results of computer simulation of faulted URD cables. Volume 1. Theory and program documentation. Final report. Joy, E.B.; Meliopoulos, A.P.; Webb, R.P. (Georgia Inst. of Tech., Atlanta (USA). School of Electrical Engineering). Jun 1981. 100p. NTIS, PC A05/MF A01. Order Number DE81903926.

A method for computing shield potentials of underground residential distribution (URD) cable shield potentials is presented. Earth potentials in the vicinity of the buried cable are also computed. The method utilizes a numerical solution of Laplace's equation to account for earth currents, and a modified nodal analysis method to account for conductor and shield currents as well as inductive coupling in the underground cable system. A computer program has been developed capable of analyzing long lengths of URD cable together with existing ground rods, faults, upon neutrals, feeding substation, and substation grounds. The system analyzed corresponds to practical URD cable distribution systems. Extensive simulation of various URD cable systems in various soil environments have been performed and the results tabulated. The simulation program employed and the applicable theory is documented in Volume 1 of this report. In Volume 2 of the report, the simulation results are documented in handbook form. From these graphs and tables, touch and step potential on the earth surface can be determined for various cable types, network connections, and soil types.

31949 (EPRI-EL—1980(Vol.1)) Component outage data analysis methods. Volume 1. Overview and special applications. Final report. Marshall, J.A.; Mazumdar, M.; McCutchan, D.A. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.). Aug 1981. 219p. NTIS, PC A10/MF A01. Order Number DE81904214.

This project addresses methods for improving the quality of outage statistics for power equipment. Statistical techniques were evaluated and applied to utility outage data to illustrate their use. Two major difficulties confront the data analyst: imprecision and inaccurate models. Imprecision stems from the limited data samples typical of generation and transmission work. To improve precision, one must first measure it; routine use of interval estimates is advocated and explained in detail. Fitting distributions is discussed for interval estimation and verifying models of equipment failure and repair. Precision can be gained by pooling data across similar experience/equipment categories; methods are demonstrated for testing data samples to be pooled. Similarly, use of regression analysis to uncover relationships and integrate information from dissimilar samples is illustrated. Errors in modeling equipment performance, e.g., neglecting dependences, are discussed and model verification by simulation is shown to be a powerful tool. Emphasis is given to infrequent events and small data samples; Bayesian analysis and model simplification (reducing the number of parameters estimated) are examined as remedies to data sparsity. Limitations to the development of improved power systems outage statistics were identified by reviewing the physical processes, existing data collection activities and the end-uses of outage statistics. A list of suggested industry research activities is provided for further evaluation.

31950 (EPRI-EL—1980(Vol.2)) Component outage data analysis methods. Volume 2. Basic statistical methods. Final report. Marshall, J.A.; Mazumdar, M.; McCutchan, D.A. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.). Aug 1981. 130p. NTIS, PC A07/MF A01. Order Number DE81904197.

This project addresses methods for improving the quality of outage statistics for power equipment. Statistical techniques were evaluated and applied to utility outage data to illustrate their use. Two major difficulties confront the data analyst: imprecision and inaccurate models. Imprecision stems from the limited data samples typical of generation and transmission work. To improve precision, one must first measure it; routine use of interval estimates is advocated and explained in detail. Fitting distributions is discussed for interval estimation and verifying models of equipment failure and repair. Precision can be gained by pooling data across similar experience/equipment categories; methods are demonstrated for testing data samples to be pooled. Similarly, use of regression analysis to uncover relationships and integrate information from dissimilar samples is illustrated. Errors in modeling equipment performance, e.g. neglecting dependences, are discussed and model verification by simulation is shown to be a powerful tool. Emphasis is given to infrequent events and small data samples; Bayesian analysis and model simplification (reducing the number of parameters estimated) are examined as remedies to data sparsity. Limitations to the development of improved power systems outage statistics were identified by reviewing the physical processes, existing data collection activities and the end-uses of outage statistics. A list of suggested industry research activities is provided for further evaluation. The concepts and tools of classical statistics that are of primary value to outage data analysis are contained in Volume 2.

31951 Keeping the surges out of the circuit. Whitaker, R.; Tahiliani, V. *EPRI (Electric Power Research Institute) Journal ;* **6**: No. 2, 24-28(Mar 1981).

An air gap forms the threshold resistance in most surge arresters; it withstands steady line voltage but is bridged by an arc when a damaging pulse must be shunted to ground. EPRI-sponsored research has produced a semiconductor that is faster, smaller, and cheaper, and it limits surges to lower levels. This device consists solely of a series of identical circular zinc oxide blocks metalized at their interfaces, stacked together in long cylinders and encapsulated in a carbon-base exterior coating which acts as a shield around the electrostatic field created by voltage on the arrester blocks. The performance of these arresters in a 1200-kV system has verified predicted results, and facilities to produce these arresters are being built. (LCL)

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31952 (ORAU—183) Nuclear engineering enrollments and degrees, 1979-1980. Gove, R.M.; Little, J.R.; Shirley, D.L. (Oak Ridge Associated Universities, Inc., TN (USA)). Aug 1981. Contract AC05-76OR00033. 67p. NTIS, PC A04/MF A01. Order Number DE81029903.

The 1980 survey includes current data on 69 institutions that reported degrees and/or enrollments. Three schools reported no students during this survey year, and three institutions have discontinued their nuclear engineering program. Since 1978, nuclear engineering enrollments have decreased by about 20% at the undergraduate and master's levels. Doctoral candidates have increased slightly in the two years since 1978. Bachelor's degree recipients have decreased since 1978 by 121 to 656 in 1980, after having increased for three years. Master's degrees awarded decreased also by 121 to 366, and the number of doctoral degrees has increased slightly since 1978 to 116.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 31984, 32016, 32020, 32023, 32052, 32071, 32196

31953 (EPRI-NP—1873) Design and fabrication of an x-ray stress analyzer. Final report. (Denver Research Inst., CO (USA)). Jun 1981. 92p. NTIS, PC A05/MF A01. Order Number DE81903772.

To investigate feasibility of fabricating an x-ray stress analyzer for measuring residual stress in austenitic stainless steel pipe, stainless steel coupons were tested first, using a laboratory breadboard set up. Successful tests, as compared to electrical resistance strain gauges were followed by tests on sample specimens of ten-inch stainless steel BWR pipes which had been seam-welded. The resulting data indicated that it would be feasible to design an instrument based on the DRI technology and apparatus. An x-ray stress analyzer for use with four-inch stainless steel BWR pipes was designed and partially assembled during the second phase of the project. Software was developed for automatic determination of the change in Debye ring diameter, including data smoothing and averaging calculations.

31954 (EPRI-NP—1898) Correlation of critical heat flux data for application to boiling water reactor conditions. Final report. Hench, J.E.; Gillis, J.C. (Levy (S.), Inc., Campbell, CA (USA)). Jun 1981. 138p. NTIS, PC A07/MF A01. Order Number DE81903815.

A study was conducted of publicly available multirod critical heat flux (CHF) data to generate a correlation which may be used to predict the limits of nucleate boiling in a boiling water reactor. A critical quality-boiling length correlation was generated which includes the effects of rod-to-rod (local) peaking factor, different axial heat flux profiles, pressure, rod diameter and bundle geometry. The CHF data base for this correlation is primarily 16-rod, with heated lengths up to 12 feet, with axially uniform and non-uniform heat flux, in a pressure range from 600 to 1400 psia, and a mass velocity range from 0.25 to 1.5 Mlb/h ft^2. The correlation predicts the critical power of the test data used to create the correlation with a standard deviation of 5.5%, and a mean value of 0.9948. When all applicable BWR CHF data are compared to the correlation, it predicts the test bundle critical power with a standard deviation of 7.5%, with a mean value of 1.0295.

31955 Interrelation of fuel performance and capacity--Yankee Atomic Electric experience. Candon, J.D. (Yankee At Electr Co, Westborough, Mass). pp 13-17 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The history surrounding the imposition of fuel operating limitations on both the Maine Yankee and Vermont Yankee reactors is discussed. The specific limitations considered are those on the rate of change of power level to prevent pellet-clad interaction. The station generation histories for Maine Yankee for 1976 and for Vermont Yankee for 1975 and 1976 are examined to determine the effect of these imposed operating limitations on the unit capacity factors. The effects of the limitations are significant and indicate a need for improved fuel designs to accommodate present day base-load generation requirements and future load following requirements for these nuclear units.

31956 Current trends in BWR fuel performance. Proebstle, R.A.; Baily, W.E.; Klepfer, H.H. (GE, San Jose, Calif). pp 38-46 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

A review of BWR fuel performance since 1973 demonstrates that design, manufacturing and operating changes have been effective in eliminating primary hydride failures and minimizing pellet clad interaction failures in General Electric manufactured fuel rods. Testing by General Electric of advanced concepts is being performed to continue to pursue additional improvements in performance margin for increased flexibility in both reactor operation and core design. This review updates the last Boiling Water Reactor

(BWR) fuel performance report in a series of reviews first initiated in 1970. 18 refs.

31957 **Light water reactor fuel rod modeling code evaluation.** Andrews, M.G.; Freeburn, H.R.; Pati, S.R. (Combust Eng Inc, Windsor, Conn). pp 104-113 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Six fuel rod modeling codes have been evaluated for potential use by the electric utility industry. The codes were ranked based on their relative prediction capability of well-characterized fuel rod performance data, their general adaptability to fuel rod modeling, and their relative expense in terms of computer running time. Standardized code inputs were developed for twelve well-characterized experimental and commercial fuel rods as part of the program, and these inputs have been provided for use by the industry for comparative rankings of other modeling codes. 8 refs.

31958 **Application of fuel performance modeling to BWR operations.** Pitek, M.T.; Rolstad, E. (Northeast Util Serv Co, Hartford, Conn). pp 147-158 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Pellet Clad Interaction (PCI) is a fuel performance problem of serious concern to utilities with operating nuclear power plants. Fuel power history tracking efforts and a plant operational strategy analysis have shed much light on the PCI problem. This paper outlines the power history tracking effort and present results of some of the Scanpower POSHO analyses, which, in conjunction with careful implementation of supplier fuel preconditioning recommendations, have led to dramatically improved fuel performance in Millstone Unit 1.

31959 **Computer modeling of the Danish BWR and PWR ramp tests.** Heckermann, H.; Strasser, A. (S.M. Stoller Corp, New York, NY). pp 189-196 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The CYGRO-3 code was used to analyze the Danish ramp tests of several BWR and PWR fuel pins, and to compare the results to the experimental data. The fuel rods were irradiated to burnups of 12,900 MWD/te UO/sub 2/ for the PWR rods and 21,200 MWD/te UO/sub 2/ for the BWR rods. After the pre-ramp irradiation, the fuel pins were removed from the reactor and nondestructively examined. Subsequently, they were re-inserted and ramped to a slightly higher power level at high ramp rates. Two out of three PWR and one out of two BWR rods failed. Computer calculations for prediction of rod failures are discussed. 7 refs.

31960 **Pellet clad interaction: experience, testing and evaluation. a KWU review.** Holzer, R.; Knoedler, D.; Stehle, H. (Kraftwerk Union, Erlangen, Ger). pp 207-218 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

With respect to power ramping the operational requirements in modern KWU-PWRs are limited by a power distribution control and a power density limitation system. Start-up after refueling at a rate of 5%/h (average) has never led to fuel failures in KWU-PWR fuel and is therefore recommended as guideline for safe operation. PCI (Pellet-Clad Interaction) failures in an older BWR plant and during one occasion in a PWR plant without the improved control system due to an abnormal control maneuver have been carefully analyzed. Prepressurized fuel rods show less propensity for PCI defects than nonpressurized fuel rods under comparable conditions. Several power ramping programs are in progress in power reactors and in research reactors in order to cover a wider field of parameters. Some observations from the post-irradiation investigations--which are not yet completed--are discussed. 11 refs.

31961 **Nature of fission-product deposits inside LWR fuel rods.** Cubicciotti, D.; Sanecki, J.S.; Strain, R.V.; Greenberg, S.; Neimark, L.A.; Johnson, C.E. (Stanford Res Inst Int, Menlo Park, Calif). pp 282-294 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The deposits of fission products observed on the inner clad surfaces of the high fission gas release population of Maine Yankee Core 1 rods and of a low gas release rod from the H.B. Robinson reactor are discussed. Available thermodynamic data are used to provide the basis for a phenomenological model for the formation of the various observed fission product deposits. The relationship between the deposits and the inferred fuel rod chemistry is discussed. 22 refs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 31955, 31957, 31959, 31960, 31961, 32016, 32020, 32051, 32054, 32073, 32074, 32075, 32077, 32078, 32153

31962 **(DOE/ET/34010—3) Evaluation and demonstration of methods for improved fuel utilization. Second semi-annual progress report, April 1 , 1980-September 30, 1980.** (Omaha Public Power District, NE (USA); Combustion Engineering, Inc., Windsor, CT (USA)). 1981. Contract AC02-79ET34010. 37p. (CEND—386). NTIS, PC A03/MF A01. Order Number DE81028397.

Demonstrations are being performed in the Fort Calhoun reactor. The current program consists of two parts, one to demonstrate low leakage fuel management (SAVFUEL - Shimmed And Very Flexible Uranium Element Loading) and the other to demonstrate high burnup. The first part will demonstrate that the power duty cycle which is characteristic of SAVFUEL does not have a deleterious effect on fuel performance, while the second part will demonstrate that the peak rod average burnup of the current 14 x 14 fuel design can be increased to 45 GWD/T. A visual examination conducted at poolside was completed on four fuel assemblies which are scheduled to demonstrate the SAVFUEL power cycle and seventeen fuel assemblies which are scheduled to provide high burnup fuel performance data. Results of visual examinations, shoulder gap closure, fuel assembly growth, and fuel rod channel width measurements are reported which show excellent fuel performance for the high burnup; demonstration assemblies after four exposure cycles. These results support an additional exposure cycle for the high burnup demonstration assemblies which currently have an assembly average burnup up to 37 GWD/T.

31963 **(DOE/ET/34022—1) Analysis of strategies for improving uranium utilization in pressurized water reactors. Annual technical progress report for FY 1980.** Sefcik, J.A.; Driscoll, M.J.; Lanning, D.D. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1981. Contract AC02-79ET34022. 245p. (MITNE—234). NTIS, PC A11/MF A01. Order Number DE81029716.

Systematic procedures have been devised and applied to evaluate core design and fuel management strategies for improving uranium utilization in Pressurized Water Reactors operated on a once-through fuel cycle. A principal objective has been the evaluation of suggested improvements on a self-consistent basis, allowing for concurrent changes in dependent variables such as core leakage and batch power histories, which might otherwise obscure the sometimes subtle effects of interest. Two levels of evaluation have been devised: a simple but accurate analytic model based on the observed linear variations in assembly reactivity as a function of burnup; and a numerical approach, embodied in a computer program, which relaxes this assumption and combines it with empirical prescriptions for assembly (or batch) power as a function of reactivity, and core leakage as a function of peripheral assembly power. State-of-the-art physics methods, such as PDQ-7, were used to verify and supplement these techniques.

31964 **(EPRI-WS—80-136) Workshop proceedings: U-bend tube cracking in steam generators.** Shoemaker, C.E. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Jun 1981. 343p. (CONF-8008122—). NTIS, PC A15/MF A01. Order Number DE81903765.

From Workshop on U-bend tube cracking in steam generators; Denver, CO, USA (20 Aug 1980).

The workshop on U-bend cracking of alloy 600 tubes in steam generators was organized by the Steam Generator Project Office. The subject areas included: concerns about U-bend cracking, occurrence and examination of U-bend cracks, factors affecting cracking of alloy 600, and environmental and other factors for corrective action.

31965 (EPRI-WS—80-157, pp A2.1-A2.19) **Operating experience with Inconel 600 tube cracking Point Beach Nuclear Plant, Units 1 and 2.** Frieling, G.D. (Wisconsin Electric Power Co., Milwaukee). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31966 (EPRI-WS—80-157, pp A3.1-A3.14) **Operating experience with Inconel 600 tube cracking at Ginna.** Curtis, A.E. III. (Rochester Gas & Electric Co., NY). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31967 (EPRI-WS—80-157, pp A4.1-A4.5) **San Onofre steam generator corrosion problem.** Simard, R. May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31968 (EPRI-WS—80-157, pp A5.1-A5.16) **San Onofre Nuclear Generating Station Unit 1. Steam generator inspection program: April 1980 - refueling outage.** May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31969 (EPRI-WS—80-157, pp A6.1-A6.29) **Secondary chemistry at recirculating PWRs.** Sawochka, S.G. (NWT Corp., San Jose, CA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31970 (EPRI-WS—80-157, pp A7.1-A7.20) **Sludge deposits and chemicals in and above tubesheet crevice.** Wootten, M.J. (Westinghouse Electric Corp., Pittsburgh, PA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31971 (EPRI-WS—80-157, pp A9.1-A9.29) **Development of new crevice cleaning method for tube-sheet-crevice of steam generator.** Yashima, S.; Ikenaga, H.; Tsuge, A.; Hirao, Y. May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31972 (EPRI-WS—80-157, pp A10.1-A10.8) **Concentration and transport mechanisms in sludge piles and tubesheet crevices.** Baum, A. (Westinghouse Electric Corp., Pittsburgh, PA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31973 (EPRI-WS—80-157, pp A11.1-A11.11) **Overview of mechanisms.** Esposito, J.N. (Westinghouse Electric Corp., Pittsburgh, PA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31974 (EPRI-WS—80-157, pp A12.1-A12.9) **Autoclave tests on alloy 600.** Nelson, J.L. (Inco R & D Center, Inc., Suffern, NY). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31975 (EPRI-WS—80-157, pp A13.1-A13.19) **Influence of sulphates and other impurities on some aspects of corrosion in PWR steam generators.** Underwood, T.C. (C.E.R.L., Leatherhead, England). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31976 (EPRI-WS—80-157, pp A14.1-A14.14) **Hydrogen induced cracking under cyclic loading of nickel base alloys used for PWR steam generator tubing.** Ballinger, R.G. (M.I.T., Cambridge, MA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31977 (EPRI-WS—80-157, pp A15.1-A15.23) **Stress corrosion cracking of Inconel 600.** Airey, G.P. (Westinghouse Electric Corp., Pittsburgh, PA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31978 (EPRI-WS—80-157, pp A18.1-A18.19) **Slide 5. Ginna Station steam generator crevice cracking: Spring 1980 outage sludge lancing.** Hutton, J. May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31979 (EPRI-WS—80-157, pp A19.1-A19.14) **Demonstration tests on tube-sheet crevice flushing procedures.** Von Nieda, G.E.; Economy, G. (Westinghouse Electric Corp., Pittsburgh, PA). May 1981. NTIS, PC A16/MF A01.

From Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice; Palo Alto, CA, USA (9 Sep 1980).

31980 **(PNL-SA—9387) Evaluation of stress-corrosion cracking of sensitized 304SS in low-temperature borated water.** Jones, R.H.; Johnson, A.B. Jr.; Bruemmer, S.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 15p. (CONF-810913—7). NTIS, PC A02/MF A01. Order Number DE81028090.

From International conference on environmental degradation of engineering materials; Blacksburg, VA, USA (21 Sep 1981).

Intergranular stress corrosion cracking has been observed in constant extension rate tests, CERT and constant load tests of 304SS tested at 32°C in borated water plus 15 ppM Cl^-. Evidence of IGSCC was obtained in CERT tests of welded pipe samples only when the original inner diameter surface was intact and with 15 ppM Cl^- added to the borated water while IGSCC occurred in a furnace sensitized pipe sample after 500 h at a constant stress of 340 MPa in borated water containing 15 ppM Cl^-. These results indicate that surface features associated with weld preparation grinding contributed to the susceptibility of sensitized 304SS to IGSCC in low temperature borated water; however, the constant

load test indicates that such surface defects are not necessary for IGSCC in low temperature borated water.

31981 (UCRL—84168) Evaluation of cracking in steam generator feedwater piping in pressurized water reactor plants. Goldberg, A.; Streit, R.D. (Lawrence Livermore National Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 32p. (CONF-811011—1). NTIS, PC A03/MF A01. Order Number DE81021834.

From 7. inter-american conference on materials technology; Mexico City, Mexico (Oct 1981).

Cracking in feedwater piping was detected near the inlet to steam generators in 15 pressurized water reactor plants. Sections with cracks from nine plants are examined with the objective of identifying the cracking mechanism and assessing various factors that might contribute to this cracking. Using transmission electron microscopy, fatigue striations are observed on replicas of cleaned crack surfaces. Calculations based on the observed striation spacings gave a cyclic stress value of 150 MPa (22 ksi) for one of the major cracks. The direction of crack propagation was invariably related to the piping surface and not to the piping axis. These two factors are consistent with the proposed concept of thermally induced, cyclic, tensile surface stresses and it is concluded that the overriding factor in the cracking problem was the presence of such undocumented cyclic loads.

31982 Analysis of eddy current data using pattern recognition methods. Doctor, P.G.; Harrington, T.P. (Battelle, Pac Northwest Lab, Richland, WA). pp 137-139 of Fifth international conference on pattern recognition. Piscataway, NJ; Institute of Electrical and Electronic Engineers (1980).

From 5. international conference on pattern recognition; Miami, FL, USA (1 Dec 1980).

Three different pattern recognition techniques were used to classify three types of machined defects in Inconel 600 steam generator tubing. The techniques included an empirical Bayes procedure, a nearest neighbor algorithm, and a multicategory linear discriminant function. The three types of defects were correctly classified with an overall accuracy of 96% to 98% depending on the technique used. Two pattern recognition algorithms, least squares and nearest neighbor, were to size uniform thinning defects in steam generator tubing. All of the defects were between 25% and 75% of the wall in depth. With the least squares algorithm, we achieved a fit correlation of 0.99 with a 95% confidence interval of (0.98, 1.00). 4 refs.

31983 Fuel performance of Surry 1 and 2. Rhodes, J.T. (Va Electr and Power Co, Richmond). pp 6-12 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The Surry 1 and 2 pressurized water reactors are in their fourth and third operating cycles, respectively. Since the start of operation, the primary fuel utilized has been standard Westinghouse 15*15 rod array LOPAR fuel assemblies. The performance of this fuel thus far has been generally quite good; however, the fuel densification-sensitive initial core fuel assemblies have had a significant impact on fuel management. In addition to the 15*15 fuel, as part of a Westinghouse/EPRI/Vepco program for 17*17 rod array assembly performance verification, two 17*17 demonstration assemblies have been under irradiation in each core since the beginning of the second cycle. The performance of this fuel has also been quite good thus far with, in particular, rod bowing that is no greater than that observed for 15*15 fuel. 1 ref.

31984 Reliabilityy and operating margins of LWR fuels. Strasser, A.A.; Lindquist, K.O. (S.M. Stoller Corp, New York, NY). pp 18-27 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The margins to fuel thermal operating limits under normal and accident conditions are key to plant operating flexibility and impact on availability and capacity factor. Fuel performance problems that do not result in clad breach, can reduce these margins. However, most have or can be solved with design changes. Regulatory changes have been major factors in eroding these margins. Various methods for regaining the margins are discussed.

31985 Performance of Exxon Nuclear Company PWR fuel elements. Gallaugher, W.C.; Jaech, J.L.; Merckx, K.R.; Wahlquist, F.P. (Exxon Nucl Co, Richland, Wash). pp 48-49 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Lead assemblies in the Ginna reactor have undergone visual examination after two cycles of irradiation with no visual rod bow observed. Approximately 8100 gage measurements of rod-to-rod spacings have been made on four bundles fom the H.B. Robinson reactor after one cycle of irradiation with no significant channel closure being observed. These measurements were made in the spent fuel basin using a strain gage leaf spring probe which was inserted midway between spacers of the assembled rods. The rod-to-rod spacing measurements have been made on the outer five rows of rods. A statistical model has been developed to interpret these rod spacing measurement data and to make statistical estimates of the rod bow. 2 refs.

31986 Combustion Engineering's fuel performance experience in operating PWRs. Andrews, M.G. (Combust Eng Inc, Windsor, Conn). pp 50-59 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Combustion Engineering (C-E) has placed seven PWRs in operation, and the data accumulated on the performance of the fuel is the subject of this paper. Pertinent performance data and statistics are presented, including I-131 activity in the coolant as an indicator of fuel rod integrity, fuel rod bowing, and the operation of the unique all-Zircaloy grids employed by C-E. 6 refs.

31987 Fuel operating experience in Westinghouse PWRs. Boman, L.H.; Caye, T.E.; Cerni, S. (Westinghouse Electr Corp, Pittsburgh, Pa). pp 60-70 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Westinghouse fuel experience from a data base of 29 plants with Zircaloy fuel clad demonstrates a continued high reliability. On-site surveillance programs indicate that previous defect mechanism such as clad hydriding due to moisture, fuel densification, clad flattening and clad defects following a rapid initial startup after refueling have been virtually eliminated. The class of potential defect mechanisms which have not compromised fuel performance (fuel rod bow, pellet-to-clad interaction at high power operation, corrosion and fretting) is undergoing extensive evaluation to verify the adequacy of the current designs and to develop design improvements. 6 refs.

31988 Review of the Babcock and Wilcox Company and Duke Power Company post irradiation examination program. Montgomery, M.H.; Mayer, J.T.; French, D.F. (Babcock and Wilcox Co, Lynchburg, Va). pp 71-81 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

An extensive post-irradiation examination program is continuing on the fuel from the Duke Power Company Oconee-1 (860 MWe) reactor. The design and operation of the fuel has been monitored through high exposure second cycle conditions. This has been done utilizing nondestructive measurement techniques at the reactor site and destructive tests performed in the BandW Lynchburg Research Center hot cells. 1 ref.

31989 Investigation of the cladding collapse phenomenon in Beznau 1 PWR. Roberts, G.; Cordall, D.; Jones, K.W.; Cornell, R.M.; Waddington, J.S. (CEGB, Berkeley, Gloucestershire, Engl). pp 92-101 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Two assemblies from the Beznau I PWR reactor have been examined to ascertain the mechanism of cladding collapse into axial gaps in the fuel-stack. It was concluded from both metallographic and modeling work that fuel densification provided a sufficiently large length change to explain the gaps observed, which developed when settling of the fuel-stack was prevented by tilted pellets, fuel fragments or asperities in the cladding. Cladding ductilities estimated from the collapsed regions agree well with previously published data. 10 refs.

31990 Considerations in modeling fission gas release during normal operation. Rumble, E.T.; Lim, E.Y.; Stuart, R.G. (Sci Appl Inc, Palo Alto, Calif). pp 123-132 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The EPRI LWR fuel rod modeling code evaluation program analyzed seven fuel rods with experimental fission gas release data. In these cases, rod-averged burnups are less than 20,000 MWD/MTM, while the fission gas release fractions range roughly from 2 to 27%. Code results demonstrate the complexities in calculating fission gas release in certain operating regimes. Beyond this work, the behavior of a pre-pressurized PWR rod is simulated to average burnups of 40,000 MWD/MTM using GAPCON-THERMAL-2. Analysis of the sensitivity of fission gas release to power histories and release correlations indicate the strong impact that LMFBR type release correlations induce at high burnup. 15 refs.

31991 Fuel modeling and performance of high burnup fuel rods. Roberts, E.; Balfour, M.G.; Hopkins, G.W.; Smalley, W.R.; Dequidt, E. (Westinghouse Electr Corp, Pittsburgh, Pa). pp 133-146 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

A number of irradiation programs have been undertaken addressing the irradiation performance of Zircaloy clad Pressurized Water Reactor fuel rods relevant to contemporary designs. The data acquired from these programs has been used as the basis for the Performance Analysis and Design (PAD) code. Models in this code for calculating pellet temperature, fuel densification and swelling, clad creep down, and fission gas release are outlined in this paper and comparisons to irradiation data are drawn. Emphasis is given to code predictions for data obtained from the Zorita Research and Development program in which fuel rods were irradiated up to peak pellet burnups of 65,000 MWD/MTU. 16 refs.

31992 Characterization of PWR power ramp tests. Knudsen, P.; Bagger, C.; Fishler, M. (Res Establ Riso, Roskilde, Den). pp 243-252 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Three identical PWR type test fuel pins were irradiated to 11,200 MWD/teUO/sub 2/ at heat loads decreasing from 510 to 340 W/cm (avg. test levels). Following nondestructive characterization, the power level was increased to 540 W/cm, at a rate of 20 W/cm.min. This caused two of the pins to fail, whereas the third survived an additional increase of 50 W/cm. The detailed post-test examination revealed cladding failures that were similar in appearance to those usually attributed to a stress-corrosion mechanism. 10 refs.

31993 PCI observation in a Combustion Engineering PWR. Fuhrman, N.; Pasupathi, V.; Corsetti, L.V. (Combust Eng Inc, Windsor, Conn). pp 262-272 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Evidence from an evaluation of the performance of Maine Yankee Core I fuel, including a comprehensive post-irradiation examination program, indicates that a number of fuel rods were perforated by a pellet-cladding interaction (PCI) mechanism assisted by fission product-induced stress corrosion. Present observations, as well as the characteristics of incipient cladding cracks found in intact rods, provided evidence of the stress corrosion-assisted PCI mechanism. Though small power ascension events are associated with the perforation history, it is concluded that the fuel temperature increase, instead of a power ramp per se, led to most of the cladding perforations. 8 refs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 31684, 31687

31994 (DOE/SF/02034—T39) 2000 MW(t) HTGR-DC-GT Modesto Site dry cooled model 346 concice. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Jul 1979. Contract AC03-78SF02034. 206p. NTIS, PC A10/MF A01. Order Number DE81024234.

Construction information is presented for a 800 MW(e) HTGR power reactor. The information is itemized for each reactor component or system and incudes quantity, labor hours, labor cost, material cost, and total costs.

31995 (DOE/SF/02034—T41) HTR multiplex utility industrial energy profile. Hamel, B.B.; Brown, H.L. (Gas-Cooled Reactor Associates, La Jolla, CA (USA); General Energy Associates, Cherry Hill, NJ (USA)). 28 Jun 1980. Contract AC03-78SF02034. 489p. NTIS, PC A21/MF A01. Order Number DE81024228.

Projected thermal power plant operating requirements are presented for electric utilities. The projections are presented for the years 1980, 1990, 2000, 2010, and 2020.

31996 (GA-A—16342) Primary loop heat exchanger for HTGR plant residual heat removal and auxiliary cooling system. Hurn, E.J.; Carosella, D.P. (General Atomic Co., San Diego, CA (USA)). Apr 1981. Contract AT03-76ET35301. 6p. (CONF-811008—1). NTIS, PC A02/MF A01.

From ASME/IEEE joint power generation conference; St Louis, MO, USA (4 Oct 1981).

For several years design studies have been under way in the US on high-temperature process heat and steam applications utilizing a high-temperature gas-cooled reactor (HTGR) plant. Plant designs have incorporated safety-class core auxiliary cooling systems (CACSs). Each CACS primary loop includes an auxiliary helium circulator, a shutoff valve, and a water-cooled core auxiliary heat exchanger (CAHE), which transfers heat from the primary coolant helium to secondary system water. This function may be for normal or plant accident conditions and is completely independent of the main heat exchanger loops. The cooling modes include pressurized cooldown, depressurized cooldown, and cooldown for maintenance, refueling, and tests. The design criteria, design configuration, performance, and safety aspects of the CAHE design are presented.

31997 (GA-D—13393(Rev.1)) Special test: PSC circulator bearing and seal system. (General Atomic Co., San Diego, CA (USA)). 1975. Contract AM03-76SF00167. 73p. NTIS, PC A04/MF A01. Order Number DE81026544.

Water leakage problems encountered during reactor operation at Fort St. Vrain necessitated special tests. The intent of these special tests was to determine the characteristics of the bearing water and buffer systems during circulator operation under various

abnormal conditions. It was anticipated tha some of these abnormal conditions could cause water leakage. To accomplish this, the existing circulator bearings, seals and brake test facility was modified to simulate, as closely as practicable, the Fort St. Vrain circulator service system. Testing included circulator pretest checkout to obtain basic data, a series of buffer system tests, a series of bearing water main drain restriction tests and a test which imposed a pressure surge on the bearing water supply system. The tests conducted simulated, as closely as practicable, the postulated normal and abnormal operating conditions which may have allowed water to escape from the circulator into the reactor.

31998 **(ORNL—5698) PEBBLE: a two-dimensional steady-state pebble bed reactor thermal hydraulics code.** Vondy, D.R. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 130p. NTIS, PC A07/MF A01. Order Number DE81030429.

This report documents the local implementation of the PEBBLE code to treat the two-dimensional steady-state pebble bed reactor thermal hydraulics problem. This code is implemented as a module of a computation system used for reactor core history calculations. Given power density data, the geometric description in (RZ), and basic heat removal conditions and thermal properties, the coolant properties, flow conditions, and temperature distributions in the pebble fuel elements are predicted. The calculation is oriented to the continuous fueling, steady state condition with consideration of the effect of the high energy neutron flux exposure and temperature history on the thermal conductivity. The coolant flow conditions are calculated for the same geometry as used in the neutronics calculation, power density and fluence data being used directly, and temperature results are made available for subsequent use.

31999 **(ORNL/TM—7674) Performance of HTGR biso- and triso-coated fertile particles irradiated in capsule HT-34.** Long, E.L. Jr.; Tiegs, T.N.; Robbins, J.M.; Kania, M.J. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 71p. NTIS, PC A04/MF A01. Order Number DE81030430.

Experiment HT-34, irradiated in the target region of the High Flux Isotope Reactor (HFIR), was designed to correlate HTGR Biso- and Triso-coated particle performance with fabrication parameters. Gamma analysis of the irradiated Triso-coated ThO_2 particles showed that the SiC deposited at the highest coating rate apparently had the best cesium-retention properties. Results of a similar analysis of the irradiated Biso-coated ThO_2 particles showed no differences in performance that could be related to coating conditions, but all the particles showed a significant loss of cesium (> 50%) at the higher temperatures. Pressure-vessel failures occurred with a significant number of particles; however, fission-gas-content measurements made at room temperature showed that the intact Biso particles from all batches except one became permeable during irradiation.

32000 **Gas-cooled nuclear power reactors.** Agnew, H.M. (General Atomic Co., San Diego, CA). *Scientific American ;* **244**: No. 6, 55-63(Jun 1981).

The development of the HTGR type reactor is reviewed. Design and operating characteristics are outlined. Safety aspects and fuel cycle considerations are described.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

32001 **Defective fuel behaviour in water reactors.** Locke, D.H. (UKAEA, Presto, Lancashire, Engl). pp 28-37 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The concept of a 'leaking' Zircaloy clad UO/sub 2/ fuel pin must be accepted by reactor designers and operators. Typical normal defect rates during 'useful-life' are between 1 in 10/sup 3/ and 1 in 10/sup 4/ fuel pins. Such leakers deteriorate slowly by chemical and metallurgical reactions. A model has been developed and is supported by post-irradiation examination and evidence of deterioration from activity release data in Winfrith Steam Generating Heavy Water Reactor. A good understanding of the performance of defective fuel can establish criteria for deciding what action a reactor operator should select in the event of fuel defection. This has led to a development program aimed at achieving a greater confidence in the handling and operating of defective fuel. 11 refs.

32002 **Examination of fuel bundles irradiated in intermittent dryout.** Bain, A.S.; Segel, A.W.L.; Novak, J. (AECL, Chalk River, Ont). pp 82-91 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The results of the post-irradiation examination of instrumented fuel bundles used for extensive in-reactor critical heat flux and post-dryout heat transfer experiments are presented. The major observations were: central melting of the UO/sub 2/; sheath temperatures much higher than detected during the irradiation; and fuel elements severely bowed. The observations are correlated through a model. Fuel failure is attributed to sheath corrosion at high temperature, and was not related to the central melting. There was no damage to the pressure tube. 5 refs.

32003 **Performance of CANDU development fuel in the NRU reactor loops.** Hardy, D.G.; Bain, A.S.; Meadowcroft, R.R. (AECL, Chalk River, Ont). pp 198-206 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

A comparison of the power ramp behavior of fuel irradiated in the vertical NRU reactor loops and in the horizontal CANDU power reactor channels shows that the effect of the magnitude of the power ramp is more severe in the loops but the effect of the ramped power level is about the same. The loop tests show that the presence of a graphite CANLUB layer between the clad and the UO/sub 2/ pellets improves the ability of the fuel to accept power ramps without defecting. The graphite layer does not have to be continuous to provide some improvement, but thick layers have proven superior to thin layers. 11 refs.

32004 **Criterion and mechanism for power ramp defects.** Garlick, A.; Gravenor, J.G. (UKAEA, Seascale, Cumbria). pp 305-314 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The problem of power ramp defects in water reactor fuel pins is discussed in relation to results recently obtained from ramp experiments in the Steam Generating Heavy Water Reactor. The likelihood of sticking between fuel and cladding is discussed and evidence presented which suggests that even at power a degree of adhesion may be expected in some fuel pins. The ramp defect mechanism is discussed in terms of fission product scc, initiation being by intergranular penetration and propagation by cleavage when suitably oriented grains are exposed to large dilatational stresses ahead of the main crack. 29 refs.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 31682, 31683, 32042, 32063, 32064, 32065, 32066, 32067, 32068, 32069, 32070, 32109, 32242

32005 (CONF-810316—, pp 81-92) **Wireless, in-vessel neutron monitor for initial core-loading of advanced breeder reactors.** DeLorenzo, J.T. (Oak Ridge National Lab., TN); Kennedy, E.J.; Blalock, T.V.; Rochelle, J.M.; Chiles, M.M.; Valentine, K.H. 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

An experimental wireless, in-vessel neutron monitor is being developed to measure the reactivity of an advanced breeder reactor as the core is loaded for the first time to preclude an accidental criticality incident. The environment is liquid sodium at a tempera-

ture of ~ 220°C, with negligible gamma or neutron radiation. With ultrasonic transmission of neutron data, no fundamental limitation has been observed after tests at 230°C for >2000 h. The neutron sensitivity was ~1 count/s-nv, and the potential data transmission rate was ~ 10^4 counts/s.

32006 **(CONF-810801—53) Testing program for concrete at temperatures to 894°K.** Naus, D.J.; Oland, C.B.; Robinson, G.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE81029144.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

A test program was conducted to define the variations in mechanical properties of a limestone aggregate concrete and a lightweight insulating concrete exposed to elevated temperatures. Four test series were conducted: (1) unconfined compression; (2) shear; (3) rebar bond; and (4) sustained loading (creep). Tests results are presented.

32007 **(CRBRP-GEFR-SP—241) Protected air-cooled condenser for the Clinch River Breeder Reactor Plant.** Louison, R.; Boardman, C.E. (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 29 May 1981. Contract AC15-76CL50003. 7p. (CONF-811008—2). NTIS, PC A02/MF A01. Order Number DE81026358.

From ASME/IEEE joint power generation conference; St Louis, MO, USA (4 Oct 1981).

The long term residual heat removal for the Clinch River Breeder Reactor Plant (CRBRP) is accomplished through the use of three protected air-cooled condensers (PACC's) each rated at 15M/sub t/ following a normal or emergency shutdown of the reactor. Steam is condensed by forcing air over the finned and coiled condenser tubes located above the steam drums. The steam flow is by natural convection. It is drawn to the PACC tube bundle for the steam drum by the lower pressure region in the tube bundle created from the condensing action. The concept of the tube bundle employs a unique patented configuration which has been commercially available through CONSECO Inc. of Medfore, Wisconsin. The concept provides semi-parallel flow that minimizes subcooling and reduces steam/condensate flow instabilities that have been observed on other similar heat transfer equipment such as moisture separator reheaters (MSRS). The improved flow stability will reduce temperature cycling and associated mechanical fatigue. The PACC is being designed to operate during and following the design basis earthquake, depressurization from the design basis tornado and is housed in protective building enclosure which is also designed to withstand the above mentioned events.

32008 **(DOE/ET/37241—44) MIT LMFBR Blanket Research Project. Quarterly progress report, July 1, 1980 - September 30, 1980.** Driscoll, M.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 9 Jan 1981. Contract AS02-76ET37241. 39p. NTIS, PC A03/MF A01. Order Number DE81027956.

Reported are evaluation of neutronics of heterogeneous LMFBR assembly and engineering compatibility of heterogeneous assembly designs. (DLC)

32009 **(DOE/SF/01435—T5) Preliminary analysis of the impact of the General Electric wave beam grid spacer on GCFR core performance.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1979. Contract AC03-77SF01435. 38p. NTIS, PC A03/MF A01. Order Number DE81029406.

This report consists of the following three separate analyses: Calculation of a Pressure Loss Coefficient for a GCFR Staggered Wave Beam Grid Spacer; Effect of Staggered Wave Beam Grid Spacer on Local Clad Temperature Distribution; and Preliminary Assessment of the Effect of Duct Dilation on Using the Staggered Grid Spacer for the GCFR.

32010 **(DOE/SF/71023—T4) Gas-cooled fast-breeder reactor. Helium Circulator Test Facility updated design cost estimate.** (General Atomic Co., San Diego, CA (USA); Parsons (Ralph M.) Co., Pasadena, CA (USA)). Apr 1979. Contract AT03-76SF71023. 245p. NTIS, PC A11/MF A01.

Costs which are included in the cost estimate are: Titles I, II, and III Architect-Engineering Services; Titles I, II, and III General Atomic Services; site clearing, grading, and excavation; bulk materials and labor of installation; mechanical and electrical equipment with installation; allowance for contractors' overhead, profit, and insurance; escalation on materials and labor; a contingency; and installation of GAC supplied equipment and materials. The total estimated cost of the facility in As Spent Dollars is $27,700,000. Also included is a cost comparison of the updated design and the previous conceptual design. There would be a considerable penalty for the direct-cooled system over the indirect-cooled system due to the excessive cost of the large diameter helium loop piping to an outdoor heat exchanger. The indirect cooled system which utilizes a helium/Dowtherm G heat exchanger and correspondingly smaller and lower pressure piping to its outdoor air cooler proved to be the more economical of the two systems.

32011 **(DOE/SF/98001—T10) Large scale breeder reactor plant prototype mechanical pump conceptual design study.** (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.; Borg-Warner Corp., Los Angeles, CA (USA). Byron Jackson Pump Div.). Jul 1976. Contract AT03-76SF98001. 725p. NTIS, PC A99/MF A01. Order Number DE81026779.

This report includes engineering memorandums, drawings, key feature descriptions, and other data. Some of the reports, such as manufacturability and some stress analysis, were done by consultants for Byron Jackson. Review of this report indicates that the design is feasible. The pump can be manufactured to system and specification requirements. The overall length and weight of some pieces will require special consideration, but is within the scope of equipment and technology available today. The fabricated parts are large and heavy, but can be manufactured and machined. Only the high temperature is unique to this size, since previous sodium pumps were smaller. Nondestructive tests as required by the Code are described and are feasible. The performance test of the prototype has been studied thoroughly. It is feasible for a cold water test. There are some problem areas. However, all of them can be solved. Development needs include building and testing a small scale model.

32012 **(HEDL-SA—2344) Alloy development for cladding and duct applications.** Straalsund, J.L.; Johnson, G.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 2 Feb 1981. Contract AC14-76FF02170. 43p. (CONF-810606—89). NTIS, PC A03/MF A01. Order Number DE81027843.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

Three general classes of materials under development for cladding and ducts are listed. Solid solution strengthened, or austenitic, alloys are Type 316 stainless steel and D9. Precipitation hardened (also austenitic) alloys consist of D21, D66 and D68. These alloys are similar to such commercial alloys as M-813, Inconel 706, Inconel 718 and Nimonic PE-16. The third general class of alloys is composed of ferritic alloys, with current emphasis being placed on HT-9, a tempered martensitic alloy, and D67, a delta-ferritic steel. The program is comprised of three parallel paths. The current reference, or first generation alloy, is 20% cold worked Type 316 stainless steel. Second generation alloys for near-term applications include D9 and HT-9. Third generation materials consist of the precipitation strengthened steels and ferritic alloys, and are being considered for implementation at a later time than the first and second generation alloys. The development of second and third generation materials was initiated in 1974 with the selection of 35 alloys. This program has proceeded to today where there are six advanced alloys being evaluated. These alloys are the developmental alloys D9, D21, D57, D66 and D68, together with the commerical alloy, HT-9. The status of development of these alloys is summarized.

32013 **(IWGFR—37/2) International working group on fast reactors: fourteenth annual meeting. Summary report, Part II.** (International Atomic Energy Agency, Vienna (Austria)). 1981. 185p. (CONF-810389—(Summ.)(Pt.2)). NTIS (US Sales Only), PC A09/MF A01.

From 14. IAEA annual meeting; Vienna, Austria (31 Mar 1981).

Paopers are presented summarizing the fast breeder reactor programs in France, Federal Republic of Germany, Belgium, Netherlands, India, Italy, Japan, USSR, United Kingdom, USA, Switzerland, and activities at OECD.

32014 **(ORNL/TM—7845) Special power supply and control system for the gas-cooled fast reactor-core flow test loop.** Hudson, T.L. (Oak Ridge National Lab., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 73p. NTIS, PC A04/MF A01. Order Number DE81030435.

The test bundle in the Gas-Cooled Fast Reactor-Core Flow Test Loop (GCFR-CFTL) requires a source of electrical power that can be controlled accurately and reliably over a wide range of steady-state and transient power levels and skewed power distributions to simulate GCFR operating conditions. Both ac and dc power systems were studied, and only those employing silicon-controlled rectifiers (SCRs) could meet the requirements. This report summarizes the studies, tests, evaluations, and development work leading to the selection. it also presents the design, procurement, testing, and evaluation of the first 500-kVa LMPL supply. The results show that the LMPL can control 60-Hz sine wave power from 200 W to 500 kVA.

32015 **(ORNL/TM—7854) Development and adaptation of conduction and radiation heat-transfer computer codes for the CFTL.** Conklin, J.C. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 39p. NTIS, PC A03/MF A01. Order Number DE81028033.

RODCON and HOTTEL are two computational methods used to calculate thermal and radiation heat transfer for the Core Flow Test Loop (CFTL) analysis efforts. RODCON was developed at ORNL to calculate the internal temperature distribution of the fuel rod simulator (FRS) for the CFTL. RODCON solves the time-dependent heat transfer equation in two-dimensional (R angle) cylindrical coordinates at an axial plane with user-specified radial material zones and time- and position-variant surface conditions at the FRS periphery. Symmetry of the FRS periphery boundary conditions is not necessary. The governing elliptic, partial differential heat equation is cast into a fully implicit, finite-difference form by approximating the derivatives with a forward-differencing scheme with variable mesh spacing. The heat conduction path is circumferentially complete, and the potential mathematical problem at the rod center can be effectively ignored. HOTTEL is a revision of an algorithm developed by C.B. Baxi at the General Atomic Company (GAC) to be used in calculating radiation heat transfer in a rod bundle enclosed in a hexagonal duct. HOTTEL uses geometric view factors, surface emissivities, and surface areas to calculate the gray-body or composite view factors in an enclosure having multiple reflections in a nonparticipating medium.

32016 **(PNL-SA—9536) LMBFR and LWR in-core thermal-hydraulic codes: the state-of-the-art and research and development needs.** Khan, E.U.; Coomes, E.P.; Rowe, D.S.; Trent, D.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 22p. (CONF-810804—12). NTIS, PC A02/MF A01. Order Number DE81028018.

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

A review of analytical design methods used for predicting reactor core flow and temperature distributions is presented with emphasis on LMFBR's. The paper also briefly describes and contrasts the methods used for LWR's. These methods are global analysis, subchannel analysis, distributed parameter, and hybrid analysis. The evolution of the local and subchannel analysis methods is presented. Data used for code validation are also presented. Current research and development needs are identified and discussed. Areas identified for future research and development include methods and expermental data for analysis of distorted bundles and natural convection. Methods that have been developed for predicting the safety performance of LMFBR's and LWR's are not within the scope of this paper.

32017 **(PNL-TR—416) Second case of fuel-assembly damage at KNK II/1. Report UP 0281.2.** Richard, H. (comp.). (Battelle Pacific Northwest Labs., Richland, WA (USA)). 14 Aug 1981. Translation source information not available . 111p. NTIS, PC A06/MF A01. Order Number DE81028238.

This report describes the second case of fuel-assembly damage at KNK II/1 from the start of detection to localization: operation with gas leaker; operation with unbalanced load - experimental; variation of the DND signal; operation with unbalanced load - theoretical; summary of rough localization; and localization of the defective fuel assembly.

2107 Regulation And Licensing

32018 **(DOE/OR/06074—1-Vol.6) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, licensing.** (Gilbert/Commonwealth, Reading, PA (USA)). Jan 1981. Contract AS06-78OR06074. 46p. NTIS, PC A03/MF A01. Order Number DE81027390.

There are no federal regulations that are directed toward nuclear energy centers per se. Thus, there are no regulations that would prohibit the development of a NEC and likewise there are none that provide reasonable assurance that a NEC, once started, would be able to fully develop. Although there are no regulations that prevent issuance of a Construction Permit for an entire NEC at the beginning of the project, there is little likelihood that such a CP could be obtained. Perhaps the most significant federal regulation with respect to a NEC is 40 CFR 190, the Environmental Radiation Protection Standards for Nuclear Power Operations. This regulation sets standards for doses to the public from all segments of the nuclear fuel cycle, and may require, in the case of a NEC, radioactive effluents from each unit to be reduced below the limits of practicability. There appears to be no current regulations in South Carolina that would specifically impede the development of a NEC.

32019 **(EMD—81-76) Further evaluation of the proposed interim consolidation of the Nuclear Regulatory Commission.** (General Accounting Office, Washington, DC (USA)). 24 Jun 1981. 43p. General Accounting Office, Gaithersburg, MD. Order Number DE81904047.

The Chairman and the Ranking Minority Member, House Committee on Interior and Insular Affairs, asked GAO to answer nine questions on the proposed interim consolidation of the Nuclear Regulatory Commission (NRC). These questions sought additional information and explanation of matters discussed in GAO's September 11, 1980 report on the subject. GAO still believes both the proposed and an alternative NRC interim consolidation option could help strengthen NRC, but points out several unresolved issues.

2108 Economics

REFER ALSO TO CITATION(S) 31963

32020 **(DOE/ET/34035—1) Yankee atomic experience with coastdown. Report YAEC-1270.** Quan, B.L.; Malone, J.P.; Pilat, E.E. (Yankee Atomic Electric Co., Framingham, MA (USA). Nuclear Services Div.). May 1981. Contract AC02-80ET34035. 99p. NTIS, PC A05/MF A01. Order Number DE81028308.

This report summarizes Yankee Atomic's operating experience with 19 coastdowns in three different nuclear power plants. The observed effects of coastdown on plant capacity factor, efficiency, maneuverability, and fuel integrity are demonstrated. Calculations of resource requirements and fuel cycle economics for equilibrium cycles show typical savings of 3 to 5% for cycles using coastdown compared to those which produce the same energy without coastdown.

32021 **(DOE/OR/06074—1-Vol.8) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, fuel supply study.** (Gilbert/Commonwealth, Reading, PA (USA)). Jan 1981. Contract AS05-78OR06074. 23p. NTIS, PC A02/MF A01. Order Number DE81027392.

A brief study has been performed to assess the nuclear fuel requirements for the Nuclear Energy Center (NEC). Objective was to review the fuel availability, requirements, and projected fuel economics for the NEC. The study involved: assessing the availability and estimated price of uranium in future years considering the most important impacting factors of the fuel cycle; assessing the fuel requirements of the NEC (including storage); and assess some of the fuel cycle economics and benefits of the NEC. The study considers a Westinghouse 1300 MW(e) Pressurized Water Reactor (PWR) as the basis for the fuel cycle requirements. Detailed fuel cycle component costs were not considered.

32022 **(DOE/OR/06074—1-Vol.10) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, finance, ownership and taxation.** (Gilbert/Commonwealth, Reading, PA (USA)). Jan 1981. Contract AS05-78OR06074. 154p. NTIS, PC A08/MF A01. Order Number DE81027394.

This report is addressed to the issue of finance and ownership alternatives for a nuclear energy center in South Carolina. It begins by reviewing previous related work both in the Phase III NEC study and in earlier studies. The second and third sections are concerned with the market for electricity in the three state area and with current national energy policy. The next section of the study describes the leading alternative ownership forms and analyzes the strengths and weaknesses of each form including a comparison of financial and tax considerations. Following a discussion of the attitudes of the participating utilities, the final section of the report draws conclusions about the most desirable ownership form based on the judgment of the authors as well as on the comments provided by the participating utilities and other interested parties.

32023 **(GEAP—25332-2) Improved uranium utilization program, Phase I. Second semiannual report, April 1980-September 1980.** Hopkins, G.C. (comp.). (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Jan 1981. Contract AT02-79ET34223. 55p. NTIS, PC A04/MF A01. Order Number DE81023605.

The improved Uranium Utilization Program includes a Phase I evaluation of BWR design alternatives which have potential to reduce uranium requirements in once-through fuel cycles. The Phase I project is evaluating the alternatives in detail, including considerations of reliability, performance, safety, and economics; is establishing implementation development requirements, costs, and schedules; is selecting the most promising alternatives; and is developing detailed plans for Phase II projects for implementation. Emphasis is being placed on developing practical althernatives which can be demonstrated at the earliest possible date in existing operating BWR nuclear power stations. Priority is being given to alternatives which have the maximum payoff, measured by reduction of the nation's uranium resource requirements, on the shortest schedule. Alternatives included in current evaluations are: improved refueling and control rod pattern optimization, spectral shift, extended burnup, reduction in gadolinia residual, axial blanket optimization, reconstitution, once-through thorium cycles, and combinations of these alternatives.

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 32196

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 32671

32024 **(ORNL—5792) Neutronics code VALE for two-dimensional triagonal (hexagonal) and three-dimensional geometries.** Vondy, D.R.; Fowler, T.B. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 69p. NTIS, PC A04/MF A01. Order Number DE81029098.

This report documents the computer code VALE designed to solve multigroup neutronics problems with the diffusion theory approximation to neutron transport for a triagonal arrangement of mesh points on planes in two- and three-dimensional geometry. This code parallels the VENTURE neutronics code in the local computation system, making exposure and fuel management capabilities available. It uses and generates interface data files adopted in the cooperative effort sponsored by Reactor Physics RRT Division of the US DOE. The programming in FORTRAN is straightforward, although data is transferred in blocks between auxiliary storage devices and main core, and direct access schemes are used. The size of problems which can be handled is essentially limited only by cost of calculation since the arrays are variably dimensioned. The memory requirement is held down while data transfer during iteration is increased only as necessary with problem size. There is provision for the more common boundary conditions including the repeating boundary, 180° rotational symmetry, and the rotational symmetry conditions for the 30°, 60°, and 120° triangular grids on planes. A variety of types of problems may be solved: the usual neutron flux eignevalue problem, or a direct criticality search on the buckling, on a reciprocal velocity absorber (prompt mode), or on nuclide concentrations. The adjoint problem and fixed source problem may be solved, as well as the dominating higher harmonic, or the importance problem for an arbitrary fixed source.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 31928, 31930, 31933, 32378

32025 **(R/M/N—657) Elastic stress distributions in welded transition joints.** Hardy, A.K. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Dec 1972. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81903973.

A theoretical and experimental examination has been made on an English Electric Mk III Transition Joint. The analyses considered only the elastic stresses generated by the mismatch in thermal expansion coefficients of the two parent materials forming the joint. The effect of plasticity or creep were not considered. Peak elastic tensile stresses of 635 MN/M^2 (92,600 $lb/in.^2$) axial and 515 MN/m^2 (74,500 $lb/in.^2$) hoop, occurred in the ferritic and austenitic materials, respectively and the interface, for a temperature change of 565°C. Severe stress gradients were present in the interfacial regions. Good agreement was found between experiment and theory. A theoretical study of the effect of varying the interface angle between the two parent materials revealed that a small angle, i.e., normal to the longitudinal axis, produced significantly lower stresses than a joint with a large angle. The optimum angle lay within the region 0.26 to 0.52 rad (15 to 30°).

32026 **(R/M/N—731) Further finite element analysis of thermal stresses in welded transition joints.** Hardy, A.K. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Mar 1974. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81903978.

The magnitudes of thermal stress generated in welded transition joints are some 65% higher than those reported in R/M/N657. This is due to the difficulty in modelling the severe stress gradients present near the bi-material interface by the finite element method. Good agreement was found with theoretical solutions for a vertical interface (0 deg), but scatter in results from elements lying adjacent to the interface lead to the need for extrapolation, which, in regions of severe stress gradient places a limit on the accuracy of the analysis. The magnitudes calculated for angled joints indicate that reverse yielding will occur under cold start operation conditions. However, because of the need for extrapolation of the stress analysis results, the accuracy to which the magnitude of operating strain range can be predicted is limited. Consequently it is not possible at this stage to predict if the joints will survive their design requirement and heavy reliance must be placed on the results of the tests on full size joints being currently carried out at MEL.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 32049, 32291

32027 **Water Reactor Fuel Performance, ANS Topical Meeting, 1977.** Chicago, IL; American Nuclear Society (1977). 361p. (CONF-7705188—).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

This proceedings contains a collection of 36 papers by various authors. The papers are grouped into 6 sessions, discussing: fuel performance; fuel rod performance modeling; and pellet-cladding interactions--observations, and mechanisms. The last session contains panel discussion on pellet-cladding interaction problem, its causes and solutions.

32028 **(DOE/ET/34215—21) Fuel-performance-improvement program. Semiannual progress report, October 1980-March 1981.** Crouthamel, C.E.; Freshley, M.D. (Battelle Pacific Northwest Labs., Richland, WA (USA); Exxon Nuclear Co., Inc., Richland, WA (USA)). Apr 1981. Contract AC06-76RLO1830. 75p. NTIS, PC A04/MF A01. Order Number DE81029817.

Progress on the Fuel Performance Improvement Program's fuel test and demonstration irradiations is reported for the period of October 1980-March 1981. The purpose of the program is to test and demonstrate improved light water reactor fuel concepts that are more resistant to failure from pellet-cladding interaction during power increases than standard pellet fuel. This would also offer extended burnup potential and, hence, improved uranium utilization.

32029 **Fuel modelling: gap conductivity, gas bubble swelling and fission gas release.** Notley, M.J.F.; Campbell, F.R.; Hastings, I.J.; Sills, H.E. (AECL, Chalk River, Ont). pp 114-122 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Irradiation of instrumented Zircaloy- and stainless steel-clad UO/sub 2/ elements has enabled one to examine the effects of filling-gas composition and pressure, fuel-to-sheath interfacial pressure and fuel-to-sheath gap, on the fuel-to-sheath heat-transfer coefficient. The experiments confirm the applicability of current models for gas-phase conductivity. The heat-transfer coefficient varied significantly during periods following a change in filling-gas pressure; this effect is attributed to the corresponding change in volume of fission gas bubbles within the fuel. A model for fission gas behavior is proposed, based on the accumulation of gas in grain boundary bubbles by diffusion or grain boundary sweeping and release when the bubbles interlink. Predicted results agree reasonably well with experimental data. 18 refs.

32030 **Comparison of the HOTROD Code predictions with PIE data.** Raven, L.F. (Br Nucl Fuels Ltd, Preston, Lancashire, Engl). pp 159-168 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The HOTROD Code is a design oriented fuel rod modeling code, the 4B version of which is used to survey the lifetime performance of rod type oxide fuels and enable the designer to select the fuel design which best meets the operational requirements. A comparison of the code predictions with data obtained from various fuel irradiations shows reasonable agreement, and thereby confirms its acceptability for this use.

32031 **Progress in using performance models: The prediction of cladding failure.** Gittus, J.H.; Howl, D.A. (UKAEA, Preston, Lancashire, Engl). pp 169-179 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The fuel performance code SLEUTH-SEER is unique in that it predicts not only temperature and strain but also the conditions of stress, strain and (now) time-dependent crack-extension in clad over pellet cracks. Here some of its applications to LWR and SGHWR fuel are described. It is proving a good means of predicting temperature and strain. In the case of pellet-clad interaction failures in SGHW it seems that the clad is fracturing by stress-corrosion at a stress closely bracketed by the code predictions. 8 refs.

32032 **LIFE-THERMAL--a water reactor fuel rod performance analysis computer code.** Westermann, E.L.; Meieran, H.B. (O'Donnell and Assoc Inc, Pittsburgh, Pa). pp 180-188 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The effort represented in this paper covers the initial work of codifying the LIFE-THERMAL-I code. The modular format of this user oriented code lends itself to easy modification and/or addition of new models and material property relationships. Its versatility is also enhanced by the ability of the user to replace any built-in material and behavioral model coefficient with ease, simplifying the tasks of calibration and qualification. 11 refs.

32033 **ASEA-ATOM research on PCI.** Junkrans, S.; Varnild, O. pp 219-229 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

ASEA-ATOM has conducted an extensive research and development program to study pellet clad interaction in current LWR fuel and to develop various remedies. Main features in the irradiation test part of the program up to now has been ramp testing in the R2 reactor in Studsvik of a large number of rods from the Agesta PHWR, a continuous program of ramp testing in R2 of rods from the Oskarshamn 1 440 MWe BWR, ramp testing in R2 of rods from the Kahl reactor, and in core ramp testing in Oskarshamn 1. These test programs and selected results are presented. 8 refs.

32034 **Irradiation tests to characterize the PCI failure mechanism.** Davies, J.H.; Rosenbaum, H.S.; Armijo, J.S.; Proebstle, R.A.; Rowland, T.C.; Thompson, J.R.; Esch, E.L.; Romeo, G.; Rutkin, D.R. (GE, San Jose, Calif). pp 230-242 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Irradiaton tests performed in the General Electric Test Reactor (GETR) to characterize the Pellet-Cladding Interaction (PCI) fuel failure mechanism are described. These tests included power ramp testing of high burnup fuel rods as well as special mechanistic tests. The former tests showed that PCI failures occurred in fuel with appreciable exposure either during or following a local power increase. The results of the mechanistic tests indicated that the presence of fission products was needed to cause cracking. It is concluded that PCI failures are stress-corrosion (or liquid metal embrittlement) cracks caused by embrittling fission product species at locally stressed (and strained) regions in the cladding. 8 refs.

32035 **Fuel rod power ramp experiment.** Papazoglou, T.P.; Wilson, H.W. (Babcock and Wilxcox Co, Lynchburg, Va). pp 253-261 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

An experimental program to investigate several aspects of pellet-cladding interaction was conducted in the R2 reactor of AB Atomenergi at Studsvik, Sweden. Fuel rods were ramped at a rapid rate to high power levels after steady-state irradiation to burnups of 1000-1200 MWd/mtU at lower power levels. The fuel rod specimens were designed to attain hard pellet-cladding contact during the steady-state irradiation. The program provided data on highly

characterized material for the evaluation of analytical models and assessed the potential for purely mechanical cladding failure. 4 refs.

32036 Stress corrosion cracking of zircaloy fuel cladding under power ramps and in laboratory tests. Videm, K.; Lunde, L. (Inst for Atomenergi, Kjeller, Norw). pp 274-281 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Mechanical fracture of the metal phase of Zircaloy was found to occur exclusively by shear in the temperature range -195 to 340/degree/C. Stress corrosion crack propagation rates were studied for unirradiated, fatigue precracked cladding tubes. The crack propagation rate increased exponentially with the stress intensity. As slow crack propagation was intergranular and fast transgranular cleavage, fracture surface studies can be developed to reveal information about crack propagation rates and the stresses which created the cracks. Initiation and crack growth phenomena responsible for power ramp defects are briefly discussed. 13 refs.

32037 Cadmium embrittlement of Zircaloy-2. Grubb, W.T.; Morgan, M.H. III. (GE, Schenectady, NY). pp 295-304 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Cadmium severely embrittles Zircaloy-2. The phenomenon was observed to occur with solid cadmium at 300/degree/C, liquid cadmium at 340/degree/C, and cadmium dissolved in liquid cesium over a range of temperatures. In liquid cesium alone at 300/degree/C, high reduction of area and only ductile fracture morphology was observed. The effect of texture was briefly evaluated using tensile samples machined from cross-rolled plate in different orientations. The results are presented in terms of fractography, and stress-elongation data obtained by constant extension rate tensile tests. 23 refs.

32038 Characteristics and interpretation of power ramping defects. Wood, J.C.; Hardy, D.G. (AECL, Chalk River, Ont). pp 315-324 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

The phenomena associated with power ramping defects which can occur when the power of UO/sub 2/ fuel is increased after appreciable burnup are described. These include a time lapse before a defect signal, self-plugging defects, and burnup dependency. Then the post-irradiation examination of ramped fuel elements is discussed in terms of the location and appearance of clad cracks and the results of an irradiation test comprising the power ramping of fuel elements containing small quantities of iodine, cesium iodide and water are reported. Laboratory tests on irradiated and unirradiated zirconium alloys were performed to investigate iodine-induced stresss corrosion cracking (SCC)--a possible mechanism for ramping defects. The dependence of SCC is described on factors such as clad fast neutron fluence, iodine concentration, clad stress and strain, strain rate, moisture contamination, and nucleation and propagation times for cracking. Finally the in-reactor and laboratory test results are drawn together to suggest mechanistic interpretations for the effects of power ramping on fuel elements. 15 refs.

32039 Suppression of PCI induced defects by lightly undulating the bore surface of the fuel cladding. Mogard, H. (Atomenergi, Nykoping, Swed). pp 325-336 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Stress-strain analyses, supported by a few power ramp tests at Studsvik, Sweden, indicate that the geometric configuration of the clad bore profile has a strong influence on the defect formation associated with pellet-clad interaction (PCI). An improved PCI performance can be obtained by means of appropriate alterations in the shape of the bore profile: 30 regular longitudinal undulations of about 20 /mu/m height are introduced around the circumference. The result seems to be a suppression of the predominating defect mechanisms that affect conventional fuel designs, in particular defect formations associated with stress concentrations and static friction crack nucleation. 5 refs.

32040 Criterion for failure of Zircaloy cladding in a water reactor fuel rod subjected to power ramps. Smith, E.; Ranjan, G.V. (Univ of Manchester Inst of Sch and Technol, Engl). pp 337-345 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

Failure of Zircaloy cladding, due to the power ramping of a water cooled reactor fuel rod, is being investigated theoretically. This paper develops a physically-based cladding failure criterion based on a stress corrosion mechanism for cladding fracture. The criterion is that fracture occurs when the cladding attains a critical threshold stress, whose magnitude is correlated with laboratory experimental data on the fracture of Zircaloy in an iodine environment. 25 refs.

32041 Integrated laboratory methods for evaluating PCI in Zircaloy-2 fuel cladding. Coffin, L.F.; Gangloff, R.P. (GE, Schenectady, NY). pp 346-355 of Water reactor fuel performance, ans topical meeting, 1977. Chicago, IL; American Nuclear Society (1977).

From ANS topical meeting on water reactor fuel performance; St Charles, IL, USA (9 May 1981).

An integrated laboratory program to study potential solutions for PCI type cracking of Zircaloy clad UO/sub 2/ fuel is summarized. The program provided both a mechanistic understanding of pellet-clad interaction (PCI), and information from conservative screening tests. Specific test techniques and selected results are presented for the localized ductility method, including constant extension rate and defected sample test conditions, and for the plane strain tensile test as approaches to evaluate material performance in I/sub 2/, Cd and Cs/Cd environments. Additional experimental methods, including the expanding mandrel and segmented expanding mandrel, were developed to simulate the PCI loading mechanism in both iodine and cadmium environments. 16 refs.

2204 Control Systems

32042 (CONF-771237—2) Clinch River Breeder Reactor Secondary Control-Rod System. McKeehan, E.R.; Sim, R.G. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). 14 Sep 1977. Contract AT03-76SF71032. 20p. NTIS, PC A02/MF A01. Order Number DE81026432.

From 1. joint US/Japan seminar on breeder reactor plant components; Los Angeles, CA, USA (5 Dec 1977).

The shutdown system for the Clinch River Breeder Reactor (CRBR) includes two independent systems, a primary and a secondary system. The Secondary Control Rod System (SCRS) is a new design which is being developed by General Electric to be diverse from the primary in order to improve overall shutdown reliability by eliminating potential common-mode failures. This paper describes the status of the SCRS design, fabrication and testing activities. Design verification testing on the component level is largely complete. These component tests will be covered with emphasis on design impact results. A prototype unit has been manufactured and system level tests in sodium have been initiated.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 32018, 32453, 32467, 32592

32043 (DOE/OR/06074—1) Final report. Conceptual studies nuclear energy center Lake Hartwell, S.C., Phase III. (Southern States Energy Board, Atlanta, GA (USA)). Jan 1981. Contract AS05-78OR06074. 149p. NTIS, PC A07/MF A01. Order Number DE81028674.

This document summarizes a conceptual study on the feasibility and practicality of developing a nuclear energy center (NEC) at a specific site in the SSEB region. The site selected for this con-

ceptual study is at Lake Hartwell, South Carolina. The conceptual NEC at Lake Hartwell consists of twelve nuclear electric generating units, arranged on the site in four clusters of three units each, known as triads. The nominal distance between triads was selected as 2-1/2 miles. Each unit was assumed to be a 1250 MW(e). The total electric output of 15,000 MWe would be transmitted to five major utilities in South Carolina, North Carolina, and Georgia. The basic finding was that the concept of a NEC on the Lake Hartwell site is feasible, but further analysis of institutional issues and possible legislation would be required.

32044 **(DOE/OR/06074—1(Exec.Summ.)) Executive summary. Conceptual studies nuclear energy center Lake Hartwell, S.C., Phase III.** (Southern States Energy Board, Atlanta, GA (USA)). Jan 1981. Contract AS05-78OR06074. 35p. NTIS, PC A03/MF A01. Order Number DE81028615.

This document summarizes a conceptual study on the feasibility and practicality of developing a nuclear energy center (NEC) at a specific site in the SSEB region. The site selected for this conceptual study is at Lake Hartwell, South Carolina. The conceptual NEC at Lake Hartwell consists of twelve 1250-MW(e) LWRs arranged on the site in four cluster of three units each, know as triads. The nominal distance between triads was selected as 2-1/2 miles. The total electric output of 15,000 MWe to be generated by the NEC would be transmitted to five major utilities in South Carolina, North Carolina, and Georgia. Objective of the study was to assess the technical, socioeconomic, environmental, and institutional issues relating to the NEC at the conceptual study site. The basic finding was that the concept of a NEC on the Lake Hartwell site is feasible, but further analysis of institutional issues and possible legislation would be required.

32045 **(DOE/OR/06074—1.-Vol.1) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, site selection.** (Sirrine (J.E.) Co., Greenville, SC (USA)). Jan 1981. Contract AS05-78OR06074. 29p. NTIS, PC A03/MF A01. Order Number DE81027404.

The Lake Hartwell site evaluation study was conducted for the Anderson County and Oconee County areas in South Carolina. The Anderson County candidate area was concluded to be more suitable than the Oconee candidate site area. (DLC)

32046 **(DOE/OR/06074—1-Vol.2) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, NEC layout, construction schemes, systems & costs.** (Ebasco Services, Inc., Norcross, GA (USA)). Jan 1981. Contract AS05-78OR06074. 85p. NTIS, PC A05/MF A01. Order Number DE81027405.

The NEC consists of 12 1300-MW(e) PWRs, regenerative cycle turbine generators, and auxiliaries, all sited on a single tract. For this study, the NEC is assumed to be located on the Hartwell Lake Site in Anderson County, South Carolina. This volume covers the NEC layout, construction schemes, systems, costs, site design parameteors (meterology, seismology, geology, demography, hydrology), decommissioning, etc.

32047 **(DOE/OR/06074—1-Vol.4) Nuclear energy center conceptual study: Phase III. Site specific evaluation. Topical report: site selection, Part 1. Existing conditions.** (Southern States Energy Board, Atlanta, GA (USA); Sirrine (J.E.) Co., Greenville, SC (USA)). Jan 1981. Contract AS05-78OR06074. 369p. NTIS, PC A16/MF A01. Order Number DE81027338.

Socio-economic factors related to the proposed siting of a 15,000 MW, twelve-unit nuclear energy center in Anderson County, South Carolina are presented. Topics include: existing socio-economic conditions in Anderson County, Hart County, and Oconee County; nuclear energy center characteristics; anticipated demographic and economic impacts of the nuclear energy center; and actions necessary to mitigate potential impacts.

32048 **(DOE/OR/06074—1-Vol.5) Nuclear energy center conceptual study: Phase III. Site specific evaluation. Topical report: technical appendix.** (Southern States Energy Board, Atlanta, GA (USA); Sirrine (J.E.) Co., Greenville, SC (USA)). Jan 1981. Contract AS05-78OR06074. 238p. NTIS, PC A11/MF A01. Order Number DE81027344.

Socio-economic factors are analyzed for the proposed 15,000 MW, twelve-unit nuclear energy center in Anderson County, South Carolina.

32049 **(DOE/OR/06074—1-Vol.7) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, transmission studies.** (Gilbert/Commonwealth, Reading, PA (USA)). Jan 1981. Contract AS05-78OR06074. 100p. NTIS, PC A05/MF A01. Order Number DE81027391.

This report presents the results of an investigation to establish feasibility, technical, and environmental assessment and estimated costs of the electric transmission system to distribute approximately 15,000 MW capacity from the proposed Nuclear Energy Center (NEC) to designated load centers. This project forms a portion of Phase III of three phase program to establish feasibility of a conceptual nuclear energy center hypothetically proposed by the Southern States Energy Board. The selection of the site for this center is covered by a separate report which locates the NEC in the area of the Lake Hartwell, South Carolina.

32050 **(DOE/OR/06074—1-Vol.9) Nuclear Energy Center conceptual study. Phase III: site-specific evaluation. Topical report, storage of low-level radioactive wastes.** (Gilbert/Commonwealth, Reading, PA (USA)). Jan 1981. Contract AS05-78OR06074. 102p. NTIS, PC A06/MF A01. Order Number DE81027393.

Several alternatives for the handling of radioactive low-level wastes (LLW) from a Nuclear Energy Center (NEC) were studied. The purpose of this study was to explore and evaluate the feasibility of disposal onsite of radioactive LLW in a shallow-land burial type disposal facility, and of temporary storage onsite of radioactive LLW with subsequent shipment for disposal at an offsite disposal facility. These disposition alternatives were evaluated in comparison to continuous shipment to an offsite disposal facility such as the existing facility at Barnwell, S.C.

32051 **(GEND—008) Citizen radiation monitoring program for the TMI area.** Baratta, A.J.; Gricar, B.G.; Jester, W.A. (EG and G Idaho, Inc., Idaho Falls (USA); Pennsylvania State Univ., University Park (USA)). Jul 1981. Contract AC07-76ID01570. 419p. NTIS, PC A18/MF A01. Order Number DE81025487.

The purpose of the program was to develop a system for citizens to independently measure radiation levels in and around their communities. This report describes the process by which the Program was developed and operated. It also presents the methods used to select and train the citizens in making and interpreting the measurements. The test procedures used to select the equipment for the program are described as are the results of the testing. Finally, the actual monitoring results are discussed along with the citizens' reactions to the program.

32052 **(MIT-EL—79-036) Operational issues involving use of supplementary cooling towers to meet stream temperature standards with application to the Browns Ferry Nuclear Plant.** Stolzenbach, K.D.; Freudberg, S.A.; Ostrowski, P.; Rhodes, J.A. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jan 1979. Contract AS02-76EV04114. 123p. (COO—4114-7). NTIS, PC A06/MF A01. Order Number DE81029717.

A mixed mode cooling system is one which operates in either the open, closed, or helper (once-through but with the use of the cooling towers) modes. Such systems may be particularly economical where the need for supplementary cooling to meet environmental constraints on induced water temperature changes is seasonal or dependent upon other transient factors such as streamflow. The issues involved in the use of mixed mode systems include the design of the open cycle and closed cycle portions of the cooling system, the specification of the environmental standard to be

met, and the monitoring system and associated decision rules used to determine when mode changes are necessary. These issues have been examined in the context of a case study of TVA's Browns Ferry Nuclear Plant which utilizes the large quantity of site specific data reflecting conditions both with and without plant operation.

32053 **(PNL-SA—9318) Independent determination of the accuracy of a research reactor stack-gas monitor.** Pickett, B.D.; Johnson, A.G. (Battelle Pacific Northwest Labs., Richland, WA (USA); Oregon State Univ., Corvallis (USA). Radiation Center). Feb 1981. Contract AC06-76RL01830. 12p. (CONF-810644—1). NTIS, PC A02/MF A01. Order Number DE81028194.

From 5. international workshop on rare earth-cobalt magnets and their application; Dayton, OH, USA (6 Jun 1981).

During normal operation of the Oregon State University TRIGA reactor (OSTR), argon-41 is produced and released to the atmosphere as a gaseous effluent through the reactor building exhaust stack. The reactor facility's stack gas monitor (SGM) continuously samples the effluent in the exhaust stack and simultaneously measures the concentration of argon-41 being released. This study was undertaken to determine the accuracy of the stack gas monitor, using techniques which were independent of the monitoring system itself. The results indicated that the argon-41 concentrations displayed by the stack gas monitor were approximately 50% of those predicted by analysis of individual samples from the exhaust system.

32054 **(TVA/OMS/OHS—81/5) Environmental radioactivity levels: Watts Bar Nuclear Plant. Annual report, 1980.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Occupational Health and Safety). Jun 1981. 53p. (RH—81-7-WBI). NTIS, PC A04/MF A01. Order Number DE81903569.

The Watts Bar Nuclear Plant (WBN), being constructed by the Tennessee Valley Authority, is located on a site owned by TVA containing 1770 acres of land in Rhea County, Tennessee, bounded on the east by Chickamauga Reservoir. See figure 1. The site is approximately 50 miles (80 kilometers) northeast of Chattanooga, Tennessee, and 8 miles (13 milometers) southeast of Spring City, Tennessee. The plant will consist of two pressurized water reactors; each unit is rated at 3411 MW(t) and 1160 MW(e). Fuel load in Unit 1 is scheduled for June 1982. A preoperational environmental radiological monitoring program was implemented in December 1976. This program has the objective of establishing a baseline of data on the distribution of natural and manmade radioactivity in the environment near the plant site. This report presents the results obtained from that program during 1980.

32055 **Unit operations used to treat process and/or waste streams at nuclear power plants.** Godbee, H.W.; Kibbey, A.H. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Nuclear and Chemical Waste Management ;* **2**: No. 1, 71-88(1981).

An attempt is made to identify the main sources of low-level radioactive wastes (LLW) that are generated at light water reactor (LWR) nuclear power plants in the United States. To place the LWR waste problem in perspective, rough estimates are given of the annual amounts of each generic type of LLW [i.e., government and commercial (fuel cycle and nonfuel cycle)] that is generated. Most of the wet solid wastes arise from the cleanup of gaseous and liquid radioactive streams prior to discharge or recycle. Many different chemical engineering unit operations have been, are being, and likely will be used to treat process and/or waste streams at LWR plants. These include adsorption, evaporation, calcination, centrifugation, compaction, crystallization, drying, filtration, incineration, reverse osmosis, and solidification of waste residues. The treatment of these various streams and the secondary wet solid wastes thus generated (e.g., filter cartridges, filter sludges, and spent ion-exchange resins) is described. The dry wastes from all LWRs have similar physical and chemical characteristics in that they can be classified as compactible, noncompactible, combustible, noncombustible, or combinations thereof. The various treatment options for concentrates or solid wet wastes, and for dry wastes are discussed. Among the dry waste treatment methods are compaction, baling, and incineration, as well as chopping, cutting, and shredding. Organic materials [liquids (e.g., oils or solvents) and/or solids] could be incinerated in most cases. 7 figures, 4 tables.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 32053

32056 **(DOE/ER/01560—15) Annual report, fiscal year 1980-1981.** Cashwell, R.J. (Wisconsin Univ., Madison (USA). Nuclear Reactor Lab.). 1981. Contract AC02-76ER01560. 16p. (COO—1560-15). NTIS, PC A02/MF A01. Order Number DE81028525.

This document reports on reactor operations, fuel exposures, shutdowns, maintenance, modifications, radioactive waste management, and environmental surveys. (DLC)

32057 **(EGG-PHYS—5500) Reactor physics analysis for the Power Burst Facility reshimming procedure.** Judd, J.L.; Nigg, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1981. Contract AC07-76ID01570. 150p. NTIS, PC A07/MF A01. Order Number DE81029219.

Extensive multidimensional reactor physics calculations connected with the planned Power Burst Facility core reshimming procedure have been completed. Reshimming will provide an approximate $1.80 increase in core excess reactivity in order to accommodate the reactivity requirements associated with the conduct of various future light water reactor fuel behavior experiments. Except for having a reduced shutdown margin, the reshimmed core has operating characteristics that are similar to those of the existing core.

32058 **(HEDL-SA—2319-S) Comparison and qualification of FFTF calorimetric methods.** McCall, T.B.; Nutt, W.T.; Zimmerman, B.D. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC14-76FF02170. 7p. (CONF-810606—91). NTIS, PC A02/MF A01. Order Number DE81028421.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The Fast Flux Test Facility achieved full power operation on December 21, 1981. During the power ascent, the reactor thermal power (calorimetric) was computed by three methods as follows: the plant main data handling computer, Plant Data System (PDS); a second computer, the Experimenter's Data System (EDS); and a manual method requiring human operator activities and a programmable calculator. It is the purpose of this paper to explain the rationale for employing the three methods, describe how each works in a schematic fashion, compare the results, and demonstrate that all methods have met stringent goals based on a statistical analysis of the results.

32059 **(HEDL-SA—2412-FP) Comparison and qualification of FFTF calorimetric methods.** Zimmerman, B.D.; Nutt, W.T.; McCall, T.B. (Hanford Engineering Development Lab., Richland, WA (USA)). May 1981. Contract AC14-76FF02170. 19p. (CONF-810606—92). NTIS, PC A02/MF A01. Order Number DE81025793.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The Fast Flux Test Facility (FFTF) uses reactor thermal power based on secondary system calorimetric calculations as the standard for calibration of nuclear power channels and safety system trip settings, and as the true reactor power for other purposes. During the startup testing of the FFTF Heat Transport System (summer 1978), it was discovered that Secondary Sodium Loops 2 and 3 have brief, randomly-occurring flow reductions. Subsequent analysis indicated these flow reductions could cause errors of several percent in the thermal power calorimetric calculations. Such an error is unacceptable. It was ultimately decided that a digital filtering approach would be taken to resolve the calorimetric problem. This paper will describe how the calorimetric calculations are performed and used at the FFTF, the nature of the problem produced by the flow reductions, the analysis done to resolve the problem, and the success achieved by that resolution.

32060 **(SAND—81-1876C) Design of a Coded-Aperture Imaging System for simulated reactor-accident experiments.** Stalker, K.T.; Kelly, J.G. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 22p. (CONF-810810—20). NTIS, PC A02/MF A01. Order Number DE81028368.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

The application of coded aperture imaging to the measurement of fuel location in nuclear fuel pins undergoing simulated reactor accident conditions is described. Modifications to normal coded aperture techniques, including the use of a one-dimensional, thick (1.5 cm) aperture, are described. The predicted and experimentally measured performance of the aperture is compared, and results of steady state imaging tests using the Coded Aperture Imaging System (CAIS) are shown.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 32000, 32051, 32060

32061 **(ALO—140) Application of disturbance analysis methodology to safety related transients in the electrical systems of a nuclear power plant. Report UCLA-ENG-8056.** Guarro, S.; Okrent, D. (Sandia National Labs., Albuquerque, NM (USA); California Univ., Los Angeles (USA). Dept. of Chemical, Nuclear, and Thermal Engineering). Aug 1981. Contract AC04-76DP00789. 161p. NTIS, PC A08/MF A01. Order Number DE81029484.

The present study tries to address the question of whether or not the computerized on-line procedures known under the name of DAS (Disturbance Analysis System) can be usefully and successfully applied to provide timely diagnostics and operational suggestions during the occurrence of a major electrical transient in the auxiliary systems of a nuclear power plant. The perspective of the study is from the plant-safety point of view. A short definition of DAS methodology features and capabilities is presented. A discussion of some of the problems of a general nature that are encountered in DAS safety-oriented applications are also included. The event insufficient power on both emergency buses, with reference to a particular plant dsign (San Onofre 1), is presented. Some transients that have recently occurred in the power supply systems of operating plants are examined. Whether or not a DAS could have successfully dealt with such occurrences is considered.

32062 **(ALO—141) Effectiveness of fire-detection systems in light-water-reactor facilities.** DiNenno, P.J.; Dungan, K.W. (Sandia National Labs., Albuquerque, NM (USA); PLC Professional Loss Control, Inc., Oak Ridge, TN (USA)). Aug 1981. Contract AC04-76DP00789. 100p. NTIS, PC A05/MF A01. Order Number DE81029465.

This report presents a critical review of methods for evaluating fire detection system capabilities. These capabilities must include some measurement of success. The problem of evaluating the effectiveness in terms of probability of success or certainty of success of fire detection systems must be answered either to enable the correct selection of system when a need is identified, or to assess the acceptability of an existing system in meeting an identified need. These methods are complementary to a hazards analysis, which identifies the need, but can be quite independent in their development and use.

32063 **(CONF-810804—13) Post-test analysis of dryout test 7B' of the W-1 Sodium Loop Safety Facility Experiment with the SABRE-2P code.** Rose, S.D.; Dearing, J.F. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE81028565.

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

An understanding of conditions that may cause sodium boiling and boiling propagation that may lead to dryout and fuel failure is crucial in liquid-metal fast-breeder reactor safety. In this study, the SABRE-2P subchannel analysis code has been used to analyze the ultimate transient of the in-core W-1 Sodium Loop Safety Facility experiment. This code has a 3-D simple nondynamic boiling model which is able to predict the flow instability which caused dryout. In other analyses dryout has been predicted for out-of-core test bundles and so this study provides additional confirmation of the model.

32064 **(DOE/ET/37227—T3) Attenuation of radiological consequences from CDA's by radiative heat transfer. Final report, 1 October 1976-31 March 1980.** Chan, S.H. (Wisconsin Univ., Milwaukee (USA). Coll. of Engineering and Applied Science). Jun 1980. Contract AS02-76ET37227. 18p. (COO—4040-8). NTIS, PC A02/MF A01. Order Number DE81029769.

The scope of the research is to investigate the general role of radiation heat transfer in attenuating the radiological consequences from core disruptive accidents of a liquid metal fast breeder reactor. Several major tasks were completed. They comprise first of all the analysis of radiative cooling in attenuating the fuel vapor in a HCDA bubble submerged in a sodium pool, and secondly the analysis of the HCDA work potential attenuation by heat losses, predominately the radiative transfer, to upper core blanket and gas plenum structures. Thirdly, a general method was developed and analysis presented to evaluate radiative transfer from a high temperature condensable mixture. Also the effect of nonequilibrium mass transfer in such a high temperature mixture pertained to HCDA bubble has been assessed. Finally, the information on thermal radiation properties (absorption and reflection) of reactor materials, that are needed for radiative heat transfer calculations in accident analyses, is presented.

32065 **(DOE/SF/10754—T2) Nuclear safety code study. Final report.** Jackson, C.; Abumansoor, K.; Myers, E.; Jesperson, D.; Cramer, E.; O'Reilly, B.; Carmichael, B. (Harvey Mudd Coll., Claremont, CA (USA)). Jun 1980. Contract FG03-79SF10754. 165p. NTIS, PC A08/MF A01. Order Number DE81027034.

An unprotected overpower accident in a Liquid Metal Fast Breeder Reactor is studied. We construct a mathematical model and derive a system of partial differential equations for the temperature. After spatial discretization, we have a large system of ordinary differential equations; the system is stiff. We solve the steady state version of our equations analytically and obtain good agreement with other work. Then we solve the time-dependent problem numerically, using two stiff techniques and one non-stiff technique. The stiff techniques are vastly more efficient than the non-stiff technique. Between the two stiff techniques, the Gear backward differentiation formulas are more efficient than an implicit Runge-Kutta type method. We also compare the use of the full neutron kinetics equations to an approximation called the zero-lifetime system. Use of the zero-lifetime system is thought to make the problem easier to solve. Results indicate this is not true when a good stiff method is used. Thus use of the zero-lifetime system is probably not necessary, and should be avoided.

32066 **(DOE/SF/70010—T33) Preliminary test results and status of acoustic leak detector development in the US.** Greene, D.A.; Smith, K.A.; Carey, W.M.; Ahlgren, F.F.; Managan, W.W.; Karplus, H.B. (General Electric Co., Sunnyvale, CA (USA); Argonne National Lab., IL (USA)). 1976. Contract AT03-76SF70010. 39p. NTIS, PC A03/MF A01.

The US has an extensive technology in the general area of acoustic surveillance. High temperature in-sodium microphones, in-vessel waveguides, and data analysis techniques have been successfully demonstrated in national development programs. This technology has been applied specifically to the development of an acoustic leak detection/location monitor for small leaks in an operating steam generator. Advanced cross-correlation signal processing techniques, coupled with either vessel mounted accelerometers or in-sodium waveguide/transducer microphone arrays, is believed to be the most promising direction for further development of such monitors. Development of signal analysis software and feasibility experiments leading to a conceptual acoustic leak detection scheme have been made. This acoustic detector has the potential for both detection and location of small leaks within short times. Careful attention has been paid to achieving effective operator interfacing. Leak de-

tection/location has been demonstrated in nonboiling geometric models simulating the steam generator, and small sodium-water reactions have been monitored in laboratory test rigs.

32067 (DOE/SF/70097—T6) Experimental studies in CDA work-energy attenuation. Quarterly progress report No. 19, 1 July to 30 September 1979. Tobin, R.J.; Cagliostro, D.J.; Romander, C.M. (SRI International, Menlo Park, CA (USA)). Oct 1979. Contract AT03-76SF70097. 8p. NTIS, PC A02/MF A01. Order Number DE81027045.

Information is presented concerning the protection of the secondary containment against reactor core disruption accident generated missiles and sodium fires.

32068 (DOE/SF/70097—T9) Effects of vessel internal structures on simulated HCDA bubble expansions. Technical Report No. 5. Tobin, R.J.; Cagliostro, D.J. (SRI International, Menlo Park, CA (USA)). Nov 1978. Contract AT03-76SF70097. 184p. NTIS, PC A09/MF A01. Order Number DE81026722.

In a transparent 1/30-scale model of a loop-type LMFBR, water simulated the sodium coolant, and nitrogen (1450 psia) or flashing water (1160 psia) simulated expansion of sodium vapor and molten fuel. The upper core structure (UCS) simulated an array of empty hexcans, and the upper internal structure (UIS) simulated the control rod and flow guides. For the nitrogen expansion, the presence of a UCS only, a UIS only, and both a UCS and UIS reduced the peak water surface velocity by 7 to 52%, the peak slug kinetic energy by 15 to 78%, the impact pressure on the cover by 19 to 51%, and the impact impulse by 11 to 27%. For the flashing water expansion, the presence of a UCS only, a UIS only, and both a UCS and UIS reduced the peak water surface velocity by 7 to 45%, the peak slug kinetic energy by 15 to 74%, the impact pressure by 28 to 71%, and the impact impulse by 22 to 25%. Results indicate that internal vessel structures markedly attenuate the potential of an HCDA transient for damaging the reactor vessel. The work potential of the nitrogen and flashing water bubble sources with and without internal structures were also compared with an adiabatic quasi-static expansion of each bubble source. Flow and nonequilibrium effects are discussed.

32069 (DOE/SF/70097—T10) Experimental studies in CDA work-energy attenuation. Fast Reactor Safety Program quarterly technical progress report No. 23, 1 July-30 September 1980. Robin R.J. (SRI International, Menlo Park, CA (USA)). 30 Sep 1980. Contract AT03-76SF70097. 5p. NTIS, PC A02/MF A01. Order Number DE81027026.

Reported is a complete analysis of experiments on the effect of coolant volatility on simulated HCDAs. Analysis of the experiment series using water, Freon 113, and Freon 11 as coolant simulants has been completed. In the Freon experiments, the upper core and bubble pressures were 50% higher, the expansion work was 25% higher, and the slug impact impulse was 29% higher than in the water experiments. In all experiments without internal structures, the coolant entrainment at slug impact was 20% to 40% of the bubble volume. Internal vessel structures reduced the slug impact impulse by 45% using Freon 113 coolant compared with 56% using water as the coolant.

32070 (ND-R—568(D)) Modelling the formation of local blockages at the grids of LMFBR subassemblies. Anderson, R. (UKAEA Dounreay Nuclear Power Development Establishment). Feb 1981. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE81904080.

Comments are made on a recently developed model for the formation of local blockages at the grids of LMFBT subassemblies. The distinction is drawn between formation of a fundamental blockage in a given subchannel and formation in any subchannel. It is shown that for a given set of parameters, for the former, blockage inception times range from a few days to more than a year, whereas, for the latter, the times range from two days to two weeks. Attention is drawn to the importance to these estimates of the debris release rate and examples are given which indicate the large range of possible values for this parameter. The paper concludes that until there is a greater mechanistic understanding of debris release, statistical models are of limited use.

32071 (NUREG—0619-REV-1) BWR feedwater nozzle and control rod drive return line nozzle cracking: resolution of generic technical activity A-10. Technical report. Snaider, R. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1980. 99p. NTIS, PC A05/MF A01.

This report summarizes work performed by the NRC staff in the resolution of Generic Technical Activity A-10, 'BWR Nozzle Cracking'. Generic Technical Activity A-10 is one of the generic technical subjects designated as 'unresolved safety issues' pursuant to Section 210 of the Energy Reorganization Act of 1974. The report describes the technical issues, the technical studies and analyses performed by the General Electric Company and the NRC staff, the staff's technical positions based on these studies, and the staff's plans for continued implementation of its technical positions. It also provides information for further work to resolve the nondestructive examination issue.

32072 (NUREG/CR—1819) Development and testing of a model for fire potential in nuclear power plants. Final report 1 Mar 78-31 May 79. Hockenbury, R.W.; Yeater, M.L. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering). Nov 1980. 133p. NTIS, PC A07/MF A01.

Approximately 235 Fire Events have been examined, classified and analyzed for various probability factors related to fires in nuclear facilities. The fire incident data bank is computerized, thus making the information readily accessible for simple sorting. The observed fire events have been used to aid in the construction of preliminary models for estimating the risk due to fires in nuclear power plants. Various aspects of the models are presented, including features to incorporate in second-phase modeling efforts.

32073 (PNL-SA—9328) Comparison of computer codes (CE-THERM, FRAP-T5, GT3-FLECHT, and TRUMP-FLECHT) with data from the NRU-LOCA thermal hydraulic tests. Mohr, C.L.; Rausch, W.N.; Hesson, G.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 9p. (CONF-810801—56). NTIS, PC A02/MF A01. Order Number DE81028136.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

The LOCA Simulation Program in the NRU reactor is the first set of experiments to provide data on the behavior of full-length, nuclear-heated PWR fuel bundles during the heatup, reflood, and quench phases of a loss-of-coolant accident (LOCA). This paper compares the temperature time histories of 4 experimental test cases with 4 computer codes: CE-THERM, FRAP-T5, GT3-FLECHT, and TRUMP-FLECHT. The preliminary comparisons between prediction and experiment show that the state-of-the art fuel codes have large uncertainties and are not necessarily conservative in predicting peak temperatures, turn around times, and bundle quench times.

32074 (PNL-SA—9461) Neutron dosimetry and spectral measurements in PWR containment. Endres, G.W.R.; Brackenbush, L.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 15p. (CONF-810673—4). NTIS, PC A02/MF A01. Order Number DE81028091.

From 4. symposium on neutron dosimetry; Munich-Neuherberg, F.R. Germany (1 Jun 1981).

The neutron spectra and absorbed dose rates in reactor containment were measured. These measurements were related to personnel dosimeter response and measurements taken with the neutron monitoring instruments at the nuclear plants. Two different systems were used to measure the neutron spectra. One system, called the multisphere or Bonner shpere system, was composed of ^{6}LiI detector which was placed inside a set of polyethylene spheres of various sizes. The multisphere system is a low resolution system which estimates the spectrum over the full range of neutron energies. The other spectrometer system was composed of a ^{3}He proportional counter filled to 4 psi ^{3}He and 26 psi argon. These ^{3}He counters have a relatively high resolution (2.5 to 3.0%) but cover the more restricted energy range from about 30 keV to $>$ 1 MeV. A pulse shape discrimination system was used to help minimize in-

terference from ^{3}He recoil reactions. A tissue equivalent proportional counter system was used for absorbed dose measurements. Because of the relatively low dose rates at many of the work locations in containment, a 5"-diameter spherical counter was used for most of these measurements. In areas of relatively high dose rate a 2" spherical counter was used. Measurements were also taken with portable neutron monitoring instruments to determine the accuracy of these devices compared to the more sophisticated sytems. Finally, several types of personnel neutron dosimeters were exposed at all the selected work locations and their responses evaluated in terms of a calibration exposure to unmoderated neutrons. (In most cases a bare ^{252}Cf neutron source.) Measurement locations were selected to represent typical work locations during entries at full power. All measurements for this study were conducted with the reactors at or near 100% power. Usually, at least 8 allocations were selected for spectrum and dose measurements.

32075 **(PNL-SA—9642) Three Mile Island zeolite vitirification demonstration program.** Siemens, D.H.; Knowlton, D.E.; Shupe, M.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 12p. (CONF-810814—5). NTIS, PC A02/MF A01. Order Number DE81028010.

From 91. national meeting of the American Institute of Chemical Engineers; Detroit, MI, USA (16 Aug 1981).

The cleanup of the high-activity-level water at Three Mile Island (TMI) provides an opportunity to further develop waste management technology. Approximately 790,000 gallons of high-activity-level water at TMI's Unit-2 Nuclear Power Station will be decontaminated at the site using the submerged demineralizer system (SDS). In the SDS process, the cesium and strontium in the water are sorbed onto zeolite that is contained within metal liners. The Department of Energy has asked the Pacific Northwest Laboratory (PNL) to take a portion of the zeolite from the SDS process and demonstrate, on a production scale, that this zeolite can be vitrified using the in-can melting process. This paper is a brief overview of the TMI zeolite vitrification program. The first section discusses the formulation of a glass suitable for immobilizing SDS zeolite. The following section describes a feed system that was developed to feed zeolite to the in-can melter. It also describes the in-can melting process and the government owned facilities in which the demonstrations will take place. Finally, the schedule for completing the program activities is outlined.

32076 **(SAND—81-1707C) Simulator data on human error probabilities.** Kozinsky, E.J.; Guttmann, H.E. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 7p. (CONF-810905—4). NTIS, PC A02/MF A01. Order Number DE81026094.

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

Analysis of operator errors on NPP simulators is being used to determine Human Error Probabilities (HEP) for task elements defined in NUREG/CR-1278. Simulator data tapes from research conducted by EPRI and ORNL are being analyzed for operator error rates. The tapes collected, using Performance Measurement System software developed for EPRI, contain a history of all operator manipulations during simulated casualties. Analysis yields a time history or Operational Sequence Diagram and a manipulation summary, both stored in computer data files. Data searches yield information on operator errors of omission and commission. This work experimentally determined HEP's for Probabilistic Risk Assessment calculations. It is the only practical experimental source of this data to date.

32077 **Comparison of the Crystal River incident with Three Mile Island.** Schultz, M.A. (Pennsylvania State Univ., University Park). pp 35-41 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The sequence of events that resulted in an incident at the Crystal River-3 reactor is reviewed. A blockage in a condensate polisher system which tripped a condensate pump initiated the incident. Operator actions following the initiating incident are descibed.

32078 **Extremely small malfunction...and then something terrible happened.** Kemeny, J.G. (Dartmouth Coll., Hanover, NH). *Environmental Professional, The ;* **1**: No. 4, 241-249(1979).

A review of the Three Mile Island-2 reactor accident is presented. Control room actions which could increase or decrease the possibility of a serious reactor incident are discussed. The role of the US NRC in maintaining reactor operator quality and nuclear power plant safety is analyzed.

25 ENERGY STORAGE

2502 Compressed Gas

REFER ALSO TO CITATION(S) 31937

32079 **(EPRI-EM—1589-Vol.3) Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 3. Project design criteria: CAES. Final report.** (Potomac Electric Power Co., Washington, DC (USA); Acres American, Inc., Columbia, MD). Apr 1981. Contract AC02-77ET28013. 218p. NTIS, PC A10/MF A01. Order Number DE81028197.

This volume documents the development of the project design criteria for a hydraulically-compensated, hard-rock mined cavern, Compressed Air Energy Storage (CAES) facility. The design criteria presented herein provided the basis for development of the design approaches and preliminary plant design presented in Volumes 9 and 12, respectively. These design criteria are based, where possible, upon related facilities and experience and are representative of normal utility practices. They cover the major plant equipment, systems, and facilities and the plant characteristics which depend upon or have an impact on plant surroundings. Project team studies and outside development contracts have concentrated on those areas where current technology or practice does not provide adequate information to support plant design activities or economic analyses.

2503 Pumped Hydro

REFER ALSO TO CITATION(S) 32456

2505 Flywheels

32080 **(UCRL—15372) Dynamic stability of stacked disk type flywheels.** Younger, F.C. (Lawrence Livermore National Lab., CA (USA); Brobeck (William M.) and Associates, Berkeley, CA (USA)). Apr 1981. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01. Order Number DE81030008.

A dynamic analysis of a flywheel assembly formed from adhesively bonded stacked fiber-composite disks was performed to determine the stiffness and rigidity of the assembly required to prevent uncontrolled growth in the deformations due to centrifugal force. The analysis shows that stacked disk type flywheels will become unstable when the speed exceeds a critical value. This critical value of speed depends upon the stiffness of the bonded attachments between the disks. Elastomeric bonds do not appear to provide adequate stiffness to insure dynamic stability for high speed stacked disk type flywheels. (LCL)

32081 **(UCRL—50056-80) Mechanical energy storage technology project. Annual report for calendar year 1980.** Barlow, T.M.; Crothers, W.T.; Chiao, T.T.; Frank, D.N.; King, D.M.; Kulkarni, S.V. (Lawrence Livermore National Lab., CA (USA)). 1 May 1981. Contract W-7405-ENG-48. 203p. NTIS, PC A10/MF A01. Order Number DE81029753.

Progress during 1980 in the Lawrence Livermore National Laboratory Mechanical Energy Storage Technology (MEST) Project is reported. This project's goals are to develop and evaluate the energy-saving potential of flywheel energy storage systems for vehicles and for fixed-base power systems. Activities related to

transportation applications; fixed-base applications; fiber-composite materials technology; flywheel rotor and containment technology; advanced component technology; and project management are described in detail. (LCL)

32082 **(UCRL—86450) Composite flywheel durability and life expectancy: test program.** Kulkarni, S.V.; Reifsnider, K.L.; Boyd, D.M. (Lawrence Livermore National Lab., CA (USA)). 14 Jul 1981. Contract W-7405-ENG-48. 13p. (CONF-810832—5). NTIS, PC A02/MF A01. Order Number DE81028849.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

The goals of this project are to: determine the durability and life expectancy of flywheel rotors; identify critical performance and durability characteristics that control the long-term service and safety of rotors and rotor containments; and develop test procedures that can be used to economically evaluate the performance of flywheels under cyclic loading in the laboratory and to relate that information to long-term service behavior. Approximately half the project is complete, including the following tasks: a material property data base has been assembled for each major material to be used in the flywheels; material property data has been characterized and modeled; the initial version of a generic test program has been designed; and some NDE characterization of all prototype composite flywheels rotors has been conducted.

32083 **(UCRL—86557) Flywheel rotor and containment technology development.** Kulkarni, S.V. (Lawrence Livermore National Lab., CA (USA)). 11 Aug 1981. Contract W-7405-ENG-48. 14p. (CONF-810833—7). NTIS, PC A02/MF A01. Order Number DE81028047.

From Mechanical, magnetic, and underground energy storage 1981 annual contractors' review meeting; Washington, DC, USA (24 Aug 1981).

The goals of the project are: to develop an economical and practical composite flywheel having an energy density of 88 Wh/kg at failure, an operational energy density of 44 to 55 Wh/kg, and an energy storage capacity of approximately 1 kWh; to determine the suitability of various manufacturing processes for low-cost rotor fabrication; to investigate flywheel and flywheel-systems dynamics; to test and evaluate prototype rotors for use in transportation and stationary applications; and to develop a fail-safe, lightweight, and low-cost flywheel containment. The following tasks have been accomplished: evaluation and selection of 1-kWh, first-generation, advanced flywheel rotor designs for subsequent development towards the DOE-established energy density goal of 88 Wh/kg at burst; completion of an advanced design concept for a flywheel primary containment structure, capable of containing the failure of a 1-kWh flywheel rotor and targeted for vehicular applications; non-destructive inspection and burst testing of approximately twenty (20) prototype rotors, and initiation of cyclic testing; completion of various activities in the areas of rotor manufacturing processes, dynamic analyses and composite materials design data generation; and initiation of an economic feasibility study to establish a rational costing methodology for composite rotors and containment.

32084 **(Y/DX—338) Rotor testing in FY 1981.** Steele, R.S. Jr.; Babelay, E.F. Jr. (Oak Ridge Y-12 Plant, TN (USA)). 13 Jul 1981. Contract W-7405-ENG-26. 8p. (CONF-810833—4). NTIS, PC A02/MF A01. Order Number DE81028340.

From Mechanical, magnetic, and underground energy storage 1981 annual contractors' review meeting; Washington, DC, USA (24 Aug 1981).

The results and observation are summarized of flywheel spin tests conducted in the Oak Ridge Flywheel Evaluation Laboratory for the Mechanical Energy Storage Technology project at the Lawrence Livermore National Laboratory (LLNL). Two types of tests are discussed. The first is an ultimate speed test similar to those performed in FY 1980. It includes ultimate speed evaluations for a tapered, quasi-isotropic, graphite composite flywheel built by LLNL, a constant thickness disk with an SMC core and circumferentially wound graphite restraining ring built by Owens-Corning Fiberglas and Lord Kinematic Corporation, and a constant thickness disk with an S-glass, α-ply layup core and circumferentially wound graphite ring built by General Electric. The second type of test is a cyclic fatigue test. A matching General Electric flywheel was used as the first test unit. Test results as well as general observations and conclusions are presented.

2506 Thermal

REFER ALSO TO CITATION(S) 31883, 32112, 32272

32085 **(SERI/TP—253-1369) Systems analysis of thermal storage.** Copeland, R.J. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1981. Contract AC02-77CH00178. 8p. (CONF-810940—2). NTIS, PC A02/MF A01. Order Number DE81030288.

From Annual meeting on thermal and chemical storage; Tysons Corner, VA, USA (16 Sep 1981).

During FY 1981, analyses were conducted on thermal storage concepts for solar thermal applications. These studies include estimates of both the obtainable costs of thermal storage concepts and their worth to a user (i.e., value). Based on obtainable costs and performance, an in-depth study evaluated thermal storage concepts for water/steam, organic fluid, and gas/Brayton solar thermal receivers. Promising and nonpromising concepts were identified. A study to evaluate thermal storage concepts for a liquid metal receiver was initiated. The value of thermal storage in a solar thermal industrial process heat application was analyzed. Several advanced concepts are being studied, including ground-mounted thermal storage for parabolic dishes with Stirling engines.

32086 **Tomorrow's systems: heat storage.** pp 59-66 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The efficiency and economic advantages of using off-peak electric power to produce heat which can be stored underground, in water, or in brick storage units in buildings, and the savings that can result from shifting building heating power demand to the utility off-peak periods are discussed. (LCL)

2508 Chemical

REFER ALSO TO CITATION(S) 32272

2509 Batteries

REFER ALSO TO CITATION(S) 32210

32087 **(AD-A—089281) Lithium-thionyl chloride battery. Quarterly report No. 6, 1 February-30 April 1980.** Dey, A.N.; Hamilton, N.; Bowden, W.; Witalis, P.; Cubbison, D. (Duracell International, Inc., Burlington, MA (USA). Lab. for Physical Science). Sep 1980. Contract DAAB07-78-C-0563. 53p. NTIS, PC A04/MF A01.

We have delivered 100 D cells to the sponsor. The cell has also been tested for capacity retention after abusive storage at 72 degrees C. We demonstrated the safety of the flat cylindrical cell during over discharge and voltage reversal at the 3.2A and 20A rates of the GLLD cell. We also studied the rate capability retention of the flat cell after storage.

32088 **(BNL—51374) Advanced alkaline electrolysis cell development task 1 summary report.** Murray, J.N. (Brookhaven National Lab., Upton, NY (USA); Teledyne Energy Systems, Timonium, MD (USA)). Apr 1980. Contract AC02-76CH00016. 69p. NTIS, PC A04/MF A01. Order Number DE81030145.

The Task 1 effort of Brookhaven National Laboratory (BNL) Contract 48021S involved continuing the investigations of improved components for the production of hydrogen (and oxygen) via d.c. electrolysis of alkaline solutions. The experimental work in Task 1 identified the C-AN structure as a very efficient cathode for alkaline solution, hydrogen evolution and the promise of PBI as a substitute for asbestos as the electrode separator was demonstrated. The planned emphasis on locating an improved anode and minimiz-

ing the voltage losses associated with the cell internal resistance offers the distinct possibility of hydrogen production at voltage efficiencies of above 92% while retaining cell operation at temperatures of 125°C or below. The relative economic impact of these technologies will be demonstrated utilizing the analytical model developed as Task 2 of the contract. This continuation of progress in the demonstration of significant improvements in the economics of the production of hydrogen should again reaffirm the intelligence of the alkaline electrolysis approach for both the current and future national needs.

32089 **(DOE/ET/25407—1) Status of the DOE battery and electrochemical technology program II.** Roberts, R. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. Contract AC01-79ET25407. 279p. (MTR—80W15). NTIS, PC A13/MF A01. Order Number DE81029879.

This report reviews the status of the Department of Energy Subelement on Electrochemical Storage Systems. It emphasizes material presented at the Department of Energy Battery and Electrochemical Contractors' Conference held December 10-12, 1979. The conference stressed secondary batteries, however, selected mechanically rechargeable batteries and aspects of energy conservation in industrial electrochemistry were included. Batteries in the research, development, and demonstration phases included are: near term: lead-acid, nickel/iron, nickel/zinc; advanced: lithium/metal sulfide, sodium/sulfur, zinc/chlorine; and research and development: metal/air, hydrogen/chlorine, zinc/bromine, redox, organic electrolytes, solid-state. Supporting research on electrode reactions, cell performance modeling, new battery materials, and other topics are included. Studies related to energy conservation and alternative processes in electrochemical industry are reviewed. The potential contributions of the battery program to the various DOE missions supported: electric vehicles, photovoltaic systems, distributed electrical energy systems, and energy conservation in industry are discussed. The report stresses advances during the period June 1978 through December 1979.

32090 **(DOE/NASA/51044—16) Response of nickel/zinc cells to electric-vehicle chopper discharge waveforms.** Cataldo, R.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1981. Contract AI01-77CS51044. 11p. (CONF-811010—1; NASA-TM—81713). NTIS, PC A02/MF A01. Order Number DE81021721.

From 6. electric vehicle council symposium; Baltimore, MD, USA (21 Oct 1981).

The preliminary results of simulated electric vehicle chopper controlled discharge of a nickel/zinc (NiZn) battery show delivered energy increases of 5 to 25 percent compared to constant current discharges of the same average current. The percentage-increase was a function of chopper frequency, the ratio of peak-to-average current, and the magnitude of the discharge current. Because the chopper effects are of a complex nature, electric vehicle battery/speed controller interaction must be carefully considered in vehicle design to optimize battery performance.

32091 **(EPRI-EM—1890) Reliability of modularized energy storage systems. Interim report.** Basin, S.L. (Science Applications, Inc., Palo Alto, CA (USA)). Jun 1981. 209p. NTIS, PC A10/MF A01. Order Number DE81903725.

The reliability of modularized electric battery energy storage systems is discussed. The measures of performance include (1) the time to first failure of the system, (2) the time between successive system failures, (3) available capacity, and (4) the number of module replacements over the planned system lifetime. The effect of module aging, under the assumption of a family of monotone failure rate distributions, is considered. The effectiveness of periodic replacement is clearly demonstrated.

32092 **(LBL—12357) Improved beta-alumina electrolytes for advanced storage batteries. Progress report, September 1980.** DeJonghe, L.C. (Lawrence Berkeley Lab., CA (USA)). Sep 1980. Contract W-7405-ENG-48. 85p. NTIS, PC A05/MF A01. Order Number DE81028118.

Beta batteries, using sodium-beta alumina solid electrolytes as an ion permeable separator between molten sodium metal and sodium polysulphide storage electrodes, continue to be technologically and economically promising systems for load leveling and for vehicle propulsion. While significant progress is being made towards developing reliable systems, a number of fundamental factors relating to durability remain poorly understood. A determining factor in the ultimate viability of the system is the lifetime of the solid electrolyte upon cell cycling. One of the problems is that a variety of electrolyte degradation processes may take place simultaneously, and that actual cell lifetime testing can take up to several years per cell. Systematic cell lifetime tests are therefore very costly. The objective of this research project is to determine the mechanisms of electrochemical failure initiation and propagation for polycrystalline Na-β alumina tubes used for the advanced storage beta batteries that are currently under development. Of particular interest is the definition of those factors that contribute adversely to slow, in-cell electrolyte degradation or to rapid failure. Progress is reported.

32093 **(LBL—13076) Thermal behavior of an experimental 2.5-kWh lithium/iron sulfide battery.** Chen, C.C.; Olszanski, T.W.; Gibbard, H.F. (Lawrence Berkeley Lab., CA (USA); Gould, Inc., Rolling Meadows, IL (USA)). Oct 1981. Contract W-7405-ENG-48. 5p. (CONF-811013—3). NTIS, PC A02/MF A01. Order Number DE81029861.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

High temperature lithium/iron sulfide batteries are currently under development for electric vehicle applications at Gould Inc. The preferred battery temperature range during operation and idle periods is 400 to 500°C. Thermal management is thus an essential part of battery design; the battery requires a thermal insulation vessel to minimize heat loss and heating and cooling systems to control temperature. Studies have been performed on the thermal energy generation and the gross thermal energy balance in the battery systems. However, information is not available on the dynamic thermal response of the system which is required for the engineering design of thermal control systems. Results of temperature measurements performed on a 2.5-kWh battery module, which was built to gain information for the design of larger systems are reported.

32094 **(PB—81-800070) Electrochemical reactions at surfaces. 1976-September, 1980 (citations from the NTIS Data Base). Report for 1976-September 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 153p. NTIS PC N01/MF N01.

This bibliography covers electrode processes in aqueous solutions. The citations discuss battery electrode reactions, fuel cell reactions, electrochemical corrosion studies, catalyst reactions, chemisorption, theoretical analysis, electrical double layer, and measurement techniques. Also included are some molten salt processes. (This updated bibliography contains 148 citations, 23 of which are new entries to the previous edition.)

32095 **(SAND—81-7135) Handbook of secondary storage batteries and charge regulators in photovoltaic systems. Final report.** (Exide Management and Technology Co., Yardley, PA (USA)). Aug 1981. Contract AC04-76DP00789. 189p. NTIS, PC A09/MF A01. Order Number DE81029464.

Solar photovoltaic systems often require battery subsystems to store reserve electrical energy for times of zero insolation. This handbook is designed to help the system designer make optimum choices of battery type, battery size and charge control circuits. Typical battery performance characteristics are summarized for four types of lead-acid batteries: pure lead, lead-calcium and lead-antimony pasted flat plate and lead-antimony tubular positive types. Similar data is also provided for pocket plate nickel cadmium batteries. Economics play a significant role in battery selection. Relative costs of each battery type are summarized under a variety of operating regimes expected for solar PV installations.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 32776

32096 (DOE/CR—0004) FY 1979 obligations and costs by state. (Department of Energy, Washington, DC (USA). Office of the Controller). Feb 1978. 191p. NTIS, PC A09/MF A01. Order Number DE81029827.

Estimates are shown for respective states on existing contracts and grants which are assumed to continue in FY 1979. Summaries are presented (by states) of: total estimated obligations and costs; capital equipment obligations and costs; operating expenses obligations and costs; construction obligations and costs. A summary of obligations and costs by mission is presented. Data are tabulated for estimated obligations and costs for each state, Washington, DC, and Puerto Rico. (MCW)

32097 (DOE/IA—0010/13) International energy indicators. Weiss, R.M. (ed.). (USDOE Assistant Secretary for International Affairs, Washington, DC. Office of Market Analysis). Jul 1981. 30p. NTIS, PC A03/MF A01. Order Number DE81028117.

Data are presented in graphs and tables on the following: world crude oil production by area, annually, 1974 through 1980, and monthly, October 1980 through April 1981; OPEC crude oil productive capacity, installed, maximum sustainable, and available, by country; world crude oil and refined product inventroy levels, 1975 (quarter IV) through 1981 (quarter I); oil consumption in OCED countries, 1975 (quarter IV) through 1981 (quarter I); USSR crude oil production and exports, 1975 through April 1981; free world (by country) and US nuclear electricity generation, 1973 through 1980 (annually) and January to May 1981 (monthly) and current capacity by country; US domestic oil supply (monthly) 1977 through 1980; US gross imports of crude oil and products, 1973 and 1974 annually, and 1975 through 1980 (annually) and monthly from January to June 1981; cost of Saudi crude oil (landed) in current and 1974 dollars (monthly) from December 1974 through March 1981; US coal trade from January 1975 to March 1981; US natural gas trade from January 1975 through April 1981; summary of US merchandise trade, quarterly, from Quarter I, 1977 through Quarter I, 1981; and US energy/GNP ratio, annually, 1974 through 1980, and quarterly from 1974 through March 1981.

32098 (DOE/MA—0021) DOE Property Management Regulations. (USDOE Assistant Secretary for Management and Administration, Washington, DC). Aug 1981. 223p. NTIS, PC A10/MF A01. Order Number DE81029825.

Subchapters include: defense materials; supply and procurement; ADP and telecommunications; transportation and motor vehicles; utilization and disposal; and industrial plant equipment. (GHT)

32099 CCE energy statement and its application to Pennsylvania . Cantieri, W.F. pp 67-79 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

The Coordinating Committee on Energy (CCE), composed of 22 member societies, issued an energy statement in 1976 that was thought to contain all the necessary elements for a good national policy. The statement concerns issues on conservation, solid fuels, oil and gas, shale oil, nuclear power, solar and other renewable sources, electric power, and long range planning. The statement is then analyzed and applied specifically to Pennsylvania. (MCW)

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 32157, 32161

32100 (BNL—50989) Comprehensive long-range energy-economy projection. Goettle, R.J. IV.; Groncki, P.J.; Hudson, E.A.; Lukachinski, J. (Brookhaven National Lab., Upton, NY (USA)). May 1979. Contract AC02-76CH00016. 75p. NTIS, PC A04/MF A01. Order Number DE81030150.

The Federal Energy Administration Act of 1974 and the Energy Conservation and Production Act (ECPA) of 1976 require that the Energy Information Administration (EIA) prepare annual forecasts of domestic energy production, conversion, and consumption for the short-, medium-, and long-time horizons. These forecasts and their supporting analyses are presented in an annual report from the EIA entitled The Administrator's Report to Congress (ARC). This report, prepared as part of the ARC Support Study, presents a single projection describing the role and evolution of the energy system in the US economy to the year 2025. The analysis is based on the application of an integrated Brookhaven National Laboratory/Dale W. Jorgenson Associates (BNL/DJA) energy-economy model system as executed under the EIA guidelines.

32101 (DOE/EIA—0293) Analysis report: applied analysis model summaries. (Department of Energy, Washington, DC (USA). Energy Information Administration). Dec 1980. 173p. NTIS, PC A08/MF A01. Order Number DE81029278.

This report contains information on models or modeling systems used by the Office of Applied Analysis, Energy Information Administration. Included the first section of this report are brief statements of each model's purpose. The second part includes more detailed information on the models' characteristics, uses, and requirements, as well as identifying sources for additional information.

32102 National energy balance. Rio de Janeiro, Brasil; Federative Republic of Brazil (1980). 106p. (NP—1903961).

Subjects addressed are: excerpts relating to energy from speeches by Brazilian President and Minister of Mines and Energy; Brazilian energy policy; and energy balance among primary energy consumption, Brazilian energy reserves and resources, imported energy, hydro power, coal, firewood, cane bagasse and charcoal, natural gas, alcohol, nuclear energy, new sources, oil shale, and petroleum. Additional tables cover electric power production, installed capacity and production forecast for hydroelectric, thermal and nuclear power. Consumption of petroleum products is given for energy and non-energy usage. Specific gravity and heat content tables are appended. (PSB)

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 31632, 31648, 31694, 31826, 31827, 32108, 32128, 32469, 32470, 32775

32103 (LA—8925-MS-Vol.1) Agricultural implications of reduced water supplies in the Green and Upper Yellowstone River Basins. Lansford, R.R.; Roach, F.; Gollehon, N.R.; Creel, B.J. (Los Alamos Scientific Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 79p. NTIS, PC A05/MF A01. Order Number DE81030181.

The growth of the energy sector in the energy-rich but water-restricted Western US has presented a potential conflict for water now used by the irrigated agricultural sector. This study measures the direct impacts on farm income and employment resulting from the transfer of water from agriculture to energy in two specific geographical areas - the Green and Upper Yellowstone River Basins. We used a linear programming model to evaluate the impacts of reduced water supplies. Through the use of regional multipliers, we expanded our analysis to include regional impacts. In the Green River Basin, we found that Duchesne and Uintah Counties, Utah, would experience the greatest economic impacts when agricultural water supplies were reduced by 50%. In the Upper Yellowstone River Basin, Treasure and Rosebud Counties, Montana, would experience the greatest total income and employment reductions when water supplies were reduced $\leq$ 40%. When these supplies were reduced by more than 40%, Stillwater, Carbon, Yellowstone, and Big Horn Counties, Montana, would experience the greatest reductions.

32104 (MIT-EL—81-009) User's guide to the Venezuelan macrofinancial model. Aliana, S.; McDonald, D. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1981. Contract AM01-76EI02295. 45p. NTIS, PC A03/MF A01. Order Number DE81029726.

This paper presents a user's guide and documentation for a macrofinancial model of Venezuela. This working paper presents

the technical aspects of the simulation model and the data developed to support the model. The model is described in Section 2, which includes all of the equations of the model, possible uses of the simulation structure, and detailed instructions on how to actually run the model on TROLL. Section 3 contains the time serie data developed for this study. Both the derivation of the data and a guide to their datafile storage on TROLL are included.

32105 **(PB—81-104937) Effects of accounting rules on utility choices of energy technologies in the United States. Final report.** Spinrad, B.I. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). Jul 1980. 29p. NTIS PC E03/MF E03.

Monetary inflation does not change the values of commodities relative to each other, only the value of money relative to commodities. Therefore, it would be expected that a comparison of the cost of technological options would not be inflation-dependent. This is borne out by the fact that when systems are compared using three different methods: (a) reducing all costs to constant-value currency and applying inflation-free discount rates; and (c) levelizing future costs at prevalent discount rates; the same relative cost figures are obtained. These three methods are used to compare five systems that supply electrical power: Light-water reactors (LWR); Liquid-metal fast-breeder reactors (LMFBR); Coal plants, with scrubbers, burning low-sulfur or processed high-sulfur coal (CS); Coal plants, with fluidized-bed combustion of high-sulfur coal (CFB); Solar power plants with sufficient storage for base-load use (SS).

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 31828, 32106, 32178, 32188, 32405, 32450, 32583, 32584, 32594

2904 Natural Resources

REFER ALSO TO CITATION(S) 32108, 32122, 32466

32106 **(LBL—12640) Urban ecosystem and resource-conserving urbanism in Third World cities.** Meier, R.L.; Berman, S.; Campbell, T.; Fitzgerald, C. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 195p. NTIS, PC A09/MF A01. Order Number DE81029854.

This study is important to the future policies of Western countries and Japan because of the rising overall of cities in the developing world is projected to match that of the developed within the span of a human generation. Although the experience reported for the cases has shown that a resource-conserving urbanism approach can be an effective tool of analysis, it is not sufficient by itself to be the foundation for a given USAID urban program. It addresses only conditions within a given urban region, while a program must take into account such matters as: (1) general conditions of political stability; (2) prospects for continued growth in international trade; (3) relationships of the national government with the United States; and (4) the funds available within the United States for covering existing commitments, and some local factors. The method is not even very sensitive to comparisons of cities for choosing the most suitable program locales because the accumulated information illuminates the uniqueness of each urban community. It will, however, generate most of the up-to-date information needed. (PSB)

32107 **(PB—81-113086) Potential use of the tiebout hypothesis in water resource project evaluation.** Sigmon, E.B.; Hite, J.C.; McLean, E.L.; Lilley, S.C.; Lovingood, P.E. Jr. (Clemson Univ., SC (USA). Water Resources Research Inst.). May 1980. Contracts DI-14-34-0001-7086;DI-14-34-0001-8043. 120p. NTIS, PC A06/MF A01.

A major problem in water resource planning and project evaluation is lack of a common denominator for use in summarizing the various accounts, especially national economic development and environmental quality accounts, required by Principles and Standards promulgated in 1973. The Tiebout hypothesis, which relates an individuals' choice of residence with Quality of Life (QOL) factors, was extended empirically by evaluating tradeoffs between QOL factors to determine the practicability in using this as an approach to overcome the problem in water resource project evaluation.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 31629, 31801, 32089

32108 **(BNL—29751) Role of large scale energy systems models in R and D planning.** Lamontagne, J. (Brookhaven National Lab., Upton, NY (USA)). Nov 1980. Contract AC02-76CH00016. 13p. (CONF-801126—3). NTIS, PC A02/MF A01. Order Number DE81026058.

From ORSA/TIMS joint national meeting; Colorado Springs, CO, USA (9 Nov 1980).

Long-term energy policy deals with the problem of finite supplies of convenient energy sources becoming more costly as they are depleted. The development of alternative technologies to provide new sources of energy and extend the lives of current ones is an attractive option available to government. Thus, one aspect of long-term energy policy involves investment in R and D. The importance of the problems addressed by R and D to the future of society (especially with regard to energy) dictates adoption of a cogent approach to resource allocation and to the designation of priorities for R and D. It is hoped that energy systems models when properly used can provide useful inputs to this process. The influence of model results on energy policy makers who are not knowledgable about flaws or uncertainties in the models, errors in assumptions in model inputs which can result in faulty forecasts, the overall usefulness of energy system models, and model limitations are discussed. It is suggested that the large scale energy systems models currently used for assessing a broad spectrum of policy issues need to be replaced with reasonably simple models capable of dealing with uncertainty in a straightforward manner, and their methodologies and the meaning of their results should be transparent, especially to those removed from the modeling process. Energy models should be clearly related to specific issues. Methodologies should be clearly related to specific decisions, and should allow adjustments to be easily made for alternative assumptions and for additional knowledge gained during the evolution of the energy system. (LCL)

32109 **(ERDA—76-97) Commercialization of new energy technologies. Appendix A. Case study 1: central station electric power generation technologies.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA). Booz, Allen Applied Research Div.). Jun 1976. Contract AC01-76ET27140. 135p. NTIS, PC A07/MF A01. Order Number DE81029852.

The results of a survey on Technologies for Central Power Generation are presented. The central power generation technologies selected for consideration were: fusion; breeder reactors; solar electric (thermal); geothermal; and magnetohydrodynamics. The responses of industry executives who make key investment decisions concerning new energy technologies and who to identify the problems faced in the development and commercialization of new energy systems are presented. Evaluation of these responses led to the following recommendations: increase industry input into the R, D and D planning process; establish and advocate priorities for new technologies based on detailed analysis of a technology's value in terms of overall national goals; create a mechanism for a joint ERDA/industry appraisal of priorities and programs; increase level of federal funding or subsidy of new technology demonstrations; and focus the activities of the national laboratories on basic research and very early product development; and emphasize industry involvement in systems development. (LCL)

32110 **(IS—4767) Ames Laboratory research report, 1980.** (Ames Lab., IA (USA)). 1980. Contract W-7405-ENG-82. 100p. NTIS, PC A05/MF A01. Order Number DE81027399.

Some of the research activities at Ames Laboratory are briefly described. Topics include coal research, solar cells, solar space heating of buildings, superconducting wires, coal carcinogens, lasers, solid waste recovery, nuclear physics, and high energy physics. Publications are listed. (WHK)

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 31694, 31743, 31764, 31952, 32019, 32101, 32470

2907 Transport And Storage

32111 **(PB—81-128704) Energy emergency contingency plan. Technical report.** (Ford, Bacon and Davis, Inc., New York (USA)). Nov 1980. 179p. NTIS, PC A09/MF A01.

This study contains the energy emergency contingency plan for the New Jersey portion of the Tri-State region. The plan details the feasibility of implementing certain contingency measures to relieve or eliminate capacity shortfalls on subsidized bus transportation under the auspices of the New Jersey Transit Corporation. The primary purpose of this study is to evaluate effective short range strategies to expand existing transit services, capable of being implemented within two weeks, should a reduction of fuel supplies curtail travel by automobile. The study area is in the nine northern counties of New Jersey under Tri-State jurisdiction.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 31922, 32123, 32124, 32187, 32188, 32197

32112 **(PNL-SA—9164) Waste heat and chill storage in aquifer systems.** Eliason, J.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 10p. (CONF-810545—6). NTIS, PC A02/MF A01. Order Number DE81028016.

From 3. conference on waste heat management and utilization; Miami, FL, USA (12 May 1981).

Seasonal storage of thermal energy in aquifers has the potential to make a significant near-term contribution towards relief of the national energy shortage. Winter chill, summer heat, and various forms of industrial waste heat and chill can be stored for future demand, thus reducing the need for generating primary energy. This seasonal storage of heat and chill in aquifer systems is being assessed as part of the Seasonal Thermal Energy Storage (STES) Program. The STES Program is managed by the Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE). The program is designed to conduct research and development studies required to provide the technical base for implementation of the Aquifer Thermal Energy Storage (ATES) concept.

2910 Conservation

REFER ALSO TO CITATION(S) 32133, 32154, 32157, 32161, 32165, 32167, 32177, 32178, 32184, 32214, 32405

32113 **(DOE/CS/60473—T1) Summary of energy conservation project.** (National Conference of State Legislatures, Washington, DC (USA). Special Task Force on Energy). 1980. Contract FG01-79CS60473. 5p. NTIS, PC A02/MF A01. Order Number DE81025738.

The objective of the project was to assist state legislatures in reviewing and implementing their state energy conservation plans. The project served as an information clearinghouse on energy conservation issues for state legislatures; produced two publications for general distribution to the legislature and use by the project; and convened workshops for individual state legislature to review energy conservation issues. A summary of activities is presented including specific results of activities in the participating state. An evaluation of the project is summarized. (MCW)

32114 **(LBL—12253-Rev.) Analysis of the energy impacts of the DOE Appropriate Energy Technology Small Grants Program: methods and results.** Lucarelli, B.; Kessel, J.; Kay, J.; Linse, J.; Tompson, S.; Homer, M. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01. Order Number DE81029844.

The study outlines methods for assessing the energy savings of projects funded by DOE in the Appropriate Technology Program (AT) and the way to apply these methods to obtain estimates of energy impacts. The energy savings potential was assessed for 57 projects from a national population of 584. Program energy savings were estimated from project savings using statistical inference. Details of the approach are discussed. Chapter 2 presents and discusses estimates of direct energy savings and Chapter 3 discusses methods and results of the economic analysis. Chapter 4 examines the indirect energy savings. Chapter 5 presents estimates of program energy savings and the methods used to obtain them. The report concludes with a discussion of how improved project selection can increase program energy savings and presents two approaches for conducting future energy impact studies. (MCW)

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 31593, 32111, 32120

32115 **(ORNL/TM—7460) Detecting outliers in energy time-series data.** Chernick, M.R.; Downing, D.J.; Pike, D.H. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 43p. NTIS, PC A03/MF A01. Order Number DE81030230.

Occasional large errors in energy data can have drastic effects on estimates for such quantities as correlation coefficients, regression coefficients, and spectral density estimates. Chernick in The Influence Function and Its Application to Data Validation (1979), illustrates the problem in the case of bivariate correlation. The problem of estimating spectral densities for time series has recently been investigated as in Kleiner, et al., Three Approaches Towards Making Power Spectra Less Vulnerable to Outliers (1976). The effect of outliers on time series is investigated by considering the influence function for the autocorrelations p(k) of a stationary time series. Effects on estimates of the spectrum for power plant data are then shown. Finally, asymptotic theory is derived for the maximum average square influence function in order to formally test for outliers in stationary Gaussian sequences.

32116 **(PB—81-850984) Systems analysis applied to energy forecasting. January, 1976-August, 1980 (citations from the Energy Data Base). Report for Jan 76-Aug 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Sep 1980. 152p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the application of systems analysis and operations research to the forecasting of energy sources, supplies, facilities, consumption, demand, and shortages. There is some consideration of energy policy futures as well. (Contains 136 citations.)

32117 **(PB—81-851024) Resource Conservation and Recovery Act (RCRA). January, 1976-September, 1980 (citations from the Energy Data Base). Report for Jan 76-Sep 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Sep 1980. 105p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning The Resource Conservation and Recovery Act (RCRA). Impacts of this Act upon various energy production processes and systems and upon the industries which use or market them are considered as well as the rules and regulations for the recovery of wastes and their utilization in energy production. (Contains 84 citations.)

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 31618, 31797, 32108, 32153

32118 **Politics and administration in Mexico: recruitment and promotion of the politico-administrative class.** Kelley, G. Austin, TX; University of Texas (1981). 18p. (NP—1903985).

Issues are discussed which shape the context of policy in Mexico. The paper is divided into two parts. The first deals with possible ways in which recruitment and promotion practices infringe on such intervening variables as coordination, innovation, information flows, participation, and responsiveness, variables which,

in turn, condition the nature and quality of the final dependent variables: the policy decision itself and its implementation, or the chain of progressively lower-level decisions. The second part attempts to contribute to the clarification of the role of the tecnicco in Mexican politics, and some tentative suggestions are advanced as to underlying changes in the political and policy process. (GHT)

32119 **Energy in Pennsylvania.** Scranton, W.W. III. pp 151-158 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

A general overview of the energy situation in Pennsylvania is presented. The energy crisis is suggested as being both political and economic in its roots. Explorations of what brought the crisis on are examined. The conditions that must be implemented to cope with the energy crisis include conservation. Production of energy in Pennsylvania is briefly discussed. (MCW)

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 31578, 31585, 31618, 31619, 31619, 31629, 31632, 31633, 31633, 31634, 31635, 31643, 31648, 31652, 32101, 32583, 32594

32120 **(DOE/PE/70278—T17) Macroeconomics and oil-supply disruptions.** Hubbard, R.G.; Fry, R.C. Jr. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Apr 1981. Contract AC01-80PE70278. 124p. NTIS, PC A06/MF A01. Order Number DE81025580.

Energy-economy interactions and domestic linkages have been used in a system of models. Domestic economic aggregates are linked with a model of the world oil market by a core macroeconomic model with real and financial sectors. The model can be used to examine the policy ramifications of various short-run scenarios. Demand factors are not taken as exogenous to the world oil market, nor are oil prices taken as exogenous to the US economy. Simulations of the model have generated endogenous cycles in the world oil market; which then affect the US economy primarily through output and inflation channels. Policy simulation was centered around the short-run imposition of a disruption tariff. The disruption tariff exhibited at least some of the desirable features noted by its proponents, though it did not function as a shield against the short-run output loss forced by the disruption. One might also simulate the rebate of tariff revenues as a reduction in the social security payroll tax. Other possible simulations include the use of any of the fiscal and monetary instruments included in the model. The effectiveness of these other policy instruments will be examined in a later paper.

32121 **Fossil-energy resources in the Western Hemisphere: plenty at a price.** Netschert, B.C. (National Economic Research Associates, Inc., Washington, DC). *Electric Perspectives ;* 25-30(Spr 1981).

The Western Hemisphere has the energy resources necessary to satisfy its needs, but many social, political, economic, and technological factors will govern the availability of those resources. The mere existence of abundant resources does not necessarily mean they will be available for consumption. A combination of conservation, the production of synthetic fuels from coal, and the use of nuclear power will provide relief until we can overcome present constraints and difficulties. The high costs of these resources will also make renewable resources more attractive.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 31772

32122 **(BNL—29764) Potential supply of synthetic fuels from Alaskan hydroelectric power and coal.** Steinberg, M.; Powell, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 15p. (CONF-810933—1). NTIS, PC A02/MF A01. Order Number DE81025743.

From IGRC 1981 conference; Chicago, IL, USA (28 Sep 1981).

It is proposed to develop and utilize the large potential hydroelectric power resources in Alaska to produce hydrogen by the electrolytic decomposition of water and to combine the hydrogen with the large Alaskan coal reserves to produce synthetic liquid and gaseous fuels. It is estimated that in this manner, as much as 1.8 million bbls/day of gasoline or 6.2 billion SCF/day of substitute natural gas can be produced. The existing and projected Alaskan pipelines would provide the means of transporting the fuels to energy consuming load centers in the US. This development would move the US a considerable way towards energy independence as well as employing the material resources in Alaska in an efficient manner.

2960 Electric Power

REFER ALSO TO CITATION(S) 31926, 32101, 32105, 32197

32123 **(ANL/CNSV-TM—76) Analysis of potential cogeneration impacts on electricity generation by the Central Maine Power Company.** Gillette, J.L.; Hub, K.A. (Argonne National Lab., IL (USA)). Apr 1981. Contract W-31-109-ENG-38. 36p. NTIS, PC A03/MF A01. Order Number DE81029991.

The potential effects of coal-fired cogeneration on the production requirements of the Central Maine Power Company were examined. Two types of cogeneration design - one utilizing a backpressure turbine, the other an extraction turbine - were studied. It was assumed that these facilities were constructed to satisfy the thermal requirements of the Keyes Fibre Company and to produce electricity that could be sold to the electric utility. The analysis included a single-year study of two different capacity-purchase options under consideration by the electric utility. An extended period was also analyzed so that the effects of demand growth and additions and subtractions of capacity on the cogeneration potential could be examined. It was found that some savings of oil could be realized with coal-based cogeneration, and that the quantity of such savings were somewhat dependent on the purchase option, the demand growth rate, and the cogenerator design. It was concluded that both cogenerator designs had some economic viability, but that the backpressure turbine type had a decided advantage due to its significantly lower heat rate.

32124 **(ANL/EES-TM—144) Preliminary evaluation of advanced coal-based electricity-generating technologies by means of system-integration analysis.** Gillette, J.L.; Hub, K.A. (Argonne National Lab., IL (USA)). Apr 1981. Contract W-31-109-ENG-38. 41p. NTIS, PC A03/MF A01. Order Number DE81029989.

The potential effects of coal-fired cogeneration on the production requirements of the Central Maine Power Company were examined. Two types of cogeneration designs - utilizing a backpressure turbine, the other an extraction turbine - were studied. It was assumed that these facilities were constructed to satisfy the thermal requirements of the Keyes Fibre Company and to produce electricity that could be sold to the electric utility. The analysis included a single-year study of two different capacity-purchase options under consideration by the electric utility. An extended period was also analyzed so that the effects of demand growth and additions and subtractions of capacity on the cogeneration potential could be examined. It was found that some savings of oil could be realized with coal-based cogeneration, and that the quantity of such savings was somewhat dependent on the purchase option, the demand growth rate, and the cogenerator design. It was concluded that both cogenerator designs had some economic viability, but that the backpressure turbine type had a decided advantage due to its significantly lower heat rate.

32125 **(CONF-810744—1) Empirical investigation of the rural cooperatives residential demand for electricity.** Maddigan, R.J.; Chern, W.S.; Gallagher, C.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01. Order Number DE81026521.

From American Association of Agricultural Economists annual meeting; Clemson, SC, USA (26 Jul 1981).

This study examines the Rural Electric Cooperatives' (RECs') residential demand for electricity using a simultaneous-

equation, partial-adjustment model developed as a component of the Oak Ridge National Laboratory Rural Electric Energy Demand (REED) model. The residential sector is described by a pair of equations in which the quantity of electricity demanded and the average electricity price are endogenous. The structural equations are estimated using regionally pooled state-level, REC-specific data for the period 1969 to 1977 for five regions. The results indicate substantial variability among regions in both the short-run and long-run response to changing prices, income and weather conditions.

32126 **(MIT-EL—79-006) Electric-power-system production costing and reliability analysis including hydroelectric, storage, and time-dependent power plants.** Finger, S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Feb 1979. Contract AM01-76EI02295. 72p. NTIS, PC A04/MF A01. Order Number DE81029733.

Electric power systems are operated to meet the fluctuating power demand at minimum cost. Electric utilities monitor the power flow throughout the system to decide what the power output from each generator should be. These decisions are based on economic criteria, but are constrained by electric stability requirements imposed by the transmission network. A complete model of the cost of operating a power system requires detailed models of, and data on, each generator and each transmission line. Such models are too complex to be used for planning studies, so many simplifying assumptions must be made. For example, most production costing models, including the one presented here, do not consider transmission or stability constraints. A standard production costing methodology that models the average generator output is discussed. The framework of the model is first presented as a deterministic model in which the customer demand is fixed and plants do not fail. Then, the model is expanded to a probabilistic model in which the customer demand and plant failures are random variables. Finally, the probabilistic model is extended to include hydroelectric, storage, and time dependent power plants; and an alternative technique for computing the effective load carrying capability of a plant is developed. The methodology presented has been implemented as three linked computer programs. ELECTRA models time dependent generators, SYSGEN performs the production costing analysis, and SCYLLA computes the load carrying capability of time dependent plants.

32127 **(MIT-EL—79-020) SYSGEN: production costing and reliability model user documentation.** Finger, S. (Massachusetts Inst. of Tech., Cambridge (USA)). Jul 1979. Contract AC01-76ET29110. 196p. NTIS, PC A09/MF A01. Order Number DE81029652.

The objective of this study was to find the least cost operating schedule subject to operating constraints and to find the frequency, duration, and probability of loss of load for a given mix of generation units and given customer demand. The program uses a modified Booth-Baleriaux technique. This methodology treats plant outages as randomly occurring loads on other plants in a utility system. The program can handle up to 34 time periods with up to 52 subperiods each and 300 generating units with five valve points. There can be up to 50 conventional hydro units and up to 50 storage units. The program requires the following general information: discout rate, customer load shapes, O and M and fuel escalation rates, immature forced outage correction factors, and for each generating unit: capacity plant lifetime, fuel cost, variable and fixed O and M costs, heat rate, mature forced outage rate, and a maintenance schedule. Optional inputs are load frequency curves, spinning reserve requirements, loading order, and for generating units: mean time repair, spinning reserve cost, and penalty factor. Three levels of output are: Initial and final load curves, system loss-of-load probability, unserved energy, and the total energy generated; all of the above, plus yearly report of the energy generated and the associated costs for each unit; and all of the above plus an echo report of the input data and additional information on conventional and pumped hydro units.

32128 **(MIT-EL—80-022) OESYS: a simulation tool for non-conventional energy applications analysis. Theoretical and operational description with user documentation.** Dinwoodie, T.L. (Massachusetts Inst. of Tech., Cambridge (USA)). Aug 1980. Contract AM01-76EI02295. 190p. NTIS, PC A09/MF A01. Order Number DE81029701.

A method is developed for assessing both the operational and economic performance of variable mixes of energy conversion technologies within their specific service environments. This method is incorporated into OESYS (Optional Energy Systems Simulator), a computer model with the specific capability to assess conditions of economic viability and service reliability for energy project evaluation. OESYS is especially well suited to handle stochastic (weather-dependent) generation technologies, and will simultaneously handle the generation, transfer, and demand of multiple energy quality levels (electricity, high/low grade thermal, liquid/gaseous fuels, etc.). The model can be applied to most use sectors, including residential, commercial, industrial and institutional, or combinations of use sectors. A model summary description is given on page 13. This paper includes a theoretical description of the types of energy applications handled by OESYS, an operational description of the model, user documentation, and three sample studies.

32129 **(MIT-EL—81-011) Integration of decentralized generators with the electric power grid.** Finger, S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1981. Contract AM01-76EI02295. 193p. NTIS, PC A09/MF A01. Order Number DE81029731.

A new methodology is developed for studying the economic interaction of customer-owned electrical generators with the central electric power grid. The purpose of the report is to study the reciprocal effects of the operation and expansion plans of the utility, and the resulting price of electricity, and the demand patterns and expansion plans of customers. The system is modeled in an open-loop feedback mode that allows both the utility and the customers to update their plans and expectations for the next time period based on the other's actions in the current time period and based on any new information such as the current price of oil. The utility and the customers solve similar operation and expansion problems, except that each has control over different variables. In addition, each may have different expectations about the future. A complete methodology encompassing these ideas is developed and implemented.

32130 **(NYSERDA—80-15-Vol.1) Monitoring and control requirement definition study for dispersed storage and generation (DSG). Final report, Volume I.** (General Electric Co., Schenectady, NY (USA)). Oct 1980. 318p. New York State Energy Research and Development Authority, Albany.

Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (< 30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, that can help achieve national energy conservation goals and can be dispersed throughout the distribution portion of an electric utility system. A study of trends reveals that the need for DSG monitoring and control equipment by 1990 to 2000 will be great. Criteria for assessing DSG integration have been defined and indicate that economic and institutational as well as technical and other factors must be included. The functional requirements for DSG monitoring and control in six major categories are emphasized here. Twenty-four functional requirements have been prepared under these 6 categories and serve to indicate how to integrate the DSGs with the distribution and other portions of the electric utility system. The results indicate that there are no fundamental technical obstacles to prevent the connection of dispersed storage and generation to the distribution system. However, a communication system of some sophistication will be requied to integrate the distribution system and the dispersed generation sources for effective control. The large-size span of generators from 10 kW to 30 MW means that a variety of remote monitoring and control may be required. An increased effort is required to develop demonstration equipment to perform the DSG monitoring and control functions and to acquire experience with this equipment in the utility distribution environment.

32131 **(NYSERDA—80-15-Vol.3) Monitoring and control requirement definition study for dispersed storage generation (DSG). Volume III. Appendix B.** (General Electric Co., Schenectady, NY (USA)). Oct 1980. 43p. New York State Energy Research and Development Authority, Albany.

A major aim of the US National Energy Policy, as well as that of the New York State Energy Research and Development Authority, is to conserve energy and to shift from oil to more abundant domestic fuels and renewable energy sources. Dispersed Storage and Generation (DSG) is the term that characterizes the present and future dispersed, relatively small (< 30 MW) energy systems, such as solar thermal electric, photovoltaic, wind, fuel cell, storage battery, hydro, and cogeneration, which can help achieve these national energy goals and can be dispersed throughout the distribution portion of an electric utility system. This document identifies the present status, trends, potential growth for selected DSGs, and implications on DSG monitoring and control. Based on current projections, it appears that DSG electrical energy will comprise only a small portion, from 4 to 10%, of the national total by the end of this century. In general, the growth potential for DSG seems favorable in the long term because of finite fossil energy resources and increasing fuel prices. Recent trends, especially in the institutional and regulatory fields, have favored greater use of DSGs for the future. This study has assimilated the considered estimates and opinions of others, for the DSG markets and the DSG's ability to serve them. So far as possible a cross section of various sources has been included in composite projections.

32132 **Electric-utility-management development: a challenge for the '80s.** Laros, M.A.; Middleton-Cook, K. *Electric Perspectives ;* 31-38(Spr 1981).

The success of electric utilities in meeting the challenge of changing operating conditions will depend on their abilities to find and train creative management teams. Utility executives and managers will have to become generalists to cope with the many forces acting on the energy industry for the rest of this century. It is an appropriate time for the industry to reevaluate its ability to provide skills-oriented training to meet the development of its future employees.

32133 **Movement toward conservation.** Douglas, J.; Lechner, M.; Zimmerman, O. *EPRI (Electric Power Research Institute) Journal ;* **6**: No. 2, 13-17(Mar 1981).

Conservation has three broad interpretations from the utility standpoint: increasing efficiency, load shifting, and substitution. By making the processes in which energy is consumed more efficient, energy supplies will last longer. Shifting electric energy use from peak-demand times (load management) could alleviate some of the nation's dependence on depleting and increasingly expensive fuel sources. National benefits can be reaped if the electric power is produced by resources indigenous to this country. Of the considerations, increasing efficiency and load shifting can be most-readily implemented and can achieve results faster. Some technologies could offer benefits in all three areas. A heat pump retrofitted in place of an oil-burning furnace is an electric space-heating system that can be adapted to load shifting; and, solar heating and cooling systems for buildings and electric vehicles are also in this category. The complex energy situations at utilities can be identified as: resource-constrained utilities and capacity-constrained utilities. Specific examples of utilities in the US in these categories and options available and being implemented are described. (MCW)

32134 **Capability of US to meet demand causes concern.** Weslowski, J. *Electrical Review International ;* **207**: No. 17, 60, 65(7 Nov 1980).

Peak demand for electricity rose 6.2% to 425 537 MW in the US this summer. With this growth in mind, the National Electric Reliability Council has concluded that major generation and transmission projects in the US must stop being hindered or the country could face extended capacity and reliability problems in the late 1980s.

32135 **Peak load pricing lowers generation costs.** Lande, R.H. *Electrical Review International ;* **207**: No. 17, 66-67(7 Nov 1980).

Before a utility implements peak load pricing for different classes of consumers the costs and the benefits should be compared. The methodology described enables a utility to determine whether peak load pricing should be introduced for specific users.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 32102, 32192, 32193, 32194, 32405, 32777

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 31775, 31799, 31800, 31801, 31805, 31809, 31826, 31827, 31828, 31833, 31838, 31855, 31857, 31859, 31862, 31863, 31864, 31909, 31914, 31917, 32114, 32128, 32166, 32450, 32469

32136 **Challenge of institutional innovations in solar codes and standards.** Pellish, D.M. (Dept. of Energy, Washington, DC). pp 47-52 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

Historical background on the development of a standards code in the area of solar energy is described. A national consensus body produced a document that reads the recommended requirements of code officials for solar heating/cooling and hot water systems. (MCW)

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 32109

32137 **(DOE/ET/11053—T1) High pressure MHD coal combustors investigation: Phase II. Final technical report.** Iwata, H.; Hamberg, R. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). May 1981. Contract AC22-78ET11053. 129p. (FE—2706-43). NTIS, PC A07/MF A01. Order Number DE81027238.

The objectives of the Phase II High Pressure MHD Coal Combustor Investigation Program were to: (1) acquire basic design and supporting engineering data through systematic combustion experiments at the 10 and 20 thermal megawatt (MW/sub t/) size and, based upon these data; (2) design a 50 MW/sub t/ combustor. This combustor was to be designed to produce an electrically conductive plasma generated by the direct combustion of pulverized coal with hot oxygen-enriched vitiated air that is seeded with potassium carbonate (K_2CO_3). Though this project uses vitiated air and oxygen as the oxidizer, preheated air will ultimately be used as the oxidizer in coal-fired MHD combustors. Primary test goals for this program include achieving (1) successful high pressure combustor operation; (2) successful structural integrity demonstration of selected combustor materials; and (3) desired output gas properties. Progress is reported. (WHK)

32138 **(DOE/ET/15518—5) Key contributions in MHD power generation. Quarterly technical progress report, 1 March 1980-31 May 1980.** Louis, J.F. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). May 1981. Contract AC01-79ET15518. 162p. NTIS, PC A08/MF A01. Order Number DE81028121.

Activities are reported in detail. Separate abstracts were prepared for progress on each of the tasks including: (1) investigation of electrical behavior in the vicinity of electrode and insulating walls; (2) studies of critical performance issues in the development of combustion disk generators; (3) development and testing of electrode modules, including studies of insulator properties; and (4) determination of coal combustion kinetics and ash behavior relevant to two-stage MHD combustors, and investigation of the mixing and flow aerodynamics of a high swirl geometry second stage. (WHK)

32139 **(DOE/ET/15601—T3) Magnetohydrodynamic research program of the MHD Energy Center at Mississippi State University and structural features of MHD radiant boilers.** Shepard, W.S. (Mississippi State Univ., Mississippi State (USA). MHD Energy Center). 1981. Contract AC02-80ET15601. 53p. NTIS, PC A04/MF A01. Order Number DE81029901.

Since 1976 Mississippi State's MHD Energy Center has been conducting MHD research sponsored by the US DOE - first into long-term corrosion of materials in radiant boilers, and since 1979 into heat recovery and seed recovery. This research has been conducted largely through use of a test stand which simulates conditions in the MHD gas stream. Continual modification of the test stand to reflect experimental results has produced a test stand capable of test runs of 100 hours; runs of more than 500 hours are being planned. The test stand is described, and experimental results are discussed. Also, the design and construction of an MHD radiant boiler at Mississippi State's MHD Energy Center are described. The radiant furnace serves several functions in a heat recovery and seed recovery system; it cools flue gases to a temperature suitable for entrance to the secondary superheater; it generates steam; it provides for the removal of molten ash at high temperatures; and it provides access for intrusive and nonintrusive instrumentation to the gas-side environment. (WHK)

32140 **(DOE/ET/15601—T4) Diagnostic instrumentation for the United States magnetohydrodynamic/heat recovery seed recovery development program.** Murphree, D.L. (Mississippi State Univ., Mississippi State (USA)). 1981. Contract AC02-80ET15601. 79p. NTIS, PC A05/MF A01. Order Number DE81029944.

The US Department of Energy's open-cycle, coal-fired Magnetohydrodynamic (MHD)/Heat Recovery Seed Recovery (HRSR) development proram requires field use instrumentation with a non-intrusive measuring capability to diagnose problems occurring in advanced MHD power trains and HRSR cycles during actual test operation without distorting the conditions being measured. The diagnostic development program in direct support of the major MHD/HRSR test facilities is described. These optical diagnostic systems are designed to characterize the internal operating environment of the MHD/HRSR components through non-intrusive, real-time, on-line analysis. The present stage of development of each instrument is discussed. A performance evaluation of these packaged, microprocessor-controlled, optical diagnostic system is presented in relation to their field-operation.

3003 Thermoelectric Generators

32141 **(DOE/ET/33003—T7) Thermoelectric-generator testing and RTG degradation-mechanisms evaluation. Progress report No. 32.** Lockwood, A. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1979. Contract AI03-76ET33003. 42p. NTIS, PC A03/MF A01. Order Number DE81024189.

Thermal conductivity tests of the older p-type were terminated after 22,000 hours. The n-type selenide legs after 8000 hours continue to show agreement with the 3M Co. published data. In the ingradient testing after 10,200 hours the n-legs show comparable performance to the reported 3M data. A new station for ingradient performance testing of the new design p-type legs with the Astroquartz/slurry wrap was nearly completed. Weight loss testing of the new design p-type TPM217 (no partition) with the Astroquartz/slurry wrap has been discontinued. A check of the last sample after 2649 hours at T/sub H/900°C and T/sub C/150°C shows a low weight loss rate, but the hot cap popped off during tests. Three 18 couple modules s/n-1,2, and 3 previously tested at RCA were received for JPL test and evaluation. S/n-1 was put on test. Testing of the ring converter was terminated after 40,939 hours. The remaining MHW generator, Q1-A, on test has accumulated 16,924 hours and performance remains stable. The performance of the Voyager 1 and 2 RTGs is reported after 17,897 hours and 18,448 hours of operation, respectively.

3004 Thermionic Converters

32142 **(DOE/ET/11292—T8) DOE advanced thermionic technology program, progress report No. 46, January, February, March 1981.** (Thermo Electron Corp., Waltham, MA (USA)). 1981. Contract AC02-76ET11292. 57p. (COO—3056-63). NTIS, PC A04/MF A01. Order Number DE81027953.

The primary long-term goal is to improve thermionic performance to the level that thermionic topping of fossil-fuel power plants becomes technically possible and economically attractive. An intermediate goal is to operate a thermionic module in a powerplant during the mid-1980's. A short-term goal is to demonstrate reliable thermionic operation in a combustion environment. Progress made during the three-month period from January through March 1981 is reported. During this period, significant accomplishments include: 1) continuing stable output from the combustion test of the one-inch diameter hemispherical silicon carbide diode (Converter No. 239) at an emitter temperature of 1730 K for a period of over 6400 hours; 3) demonstration of an additive oxygen effect in a research diode (Converter No. 258) with a cesium-graphite reservoir locate in the collector; 3) preliminary testing of the four-diode module; and 4) evaluation of a research diode (Converter No. 261) with ZrO_2-Mo cermet electrodes.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 32094

32143 **(AD-A—092814) Improvement of phosphoric acid fuel cell stacks. Final technical report Aug 77-Jun 80.** Abens, S.G.; Ascenzo, F.J.; Baker, B.S.; Garretson, G.; Lambrech, M. (Energy Research Corp., Bethel, CT (USA)). Jul 1980. Contract DAAK70-77-C-0174. 88p. NTIS, PC A05/MF A01.

Phosphoric acid fuel cell components and stack assembly methods were evaluated. Electrodes with Pt loading between 0.3 and 0.9 g/sq. ft were employed. Matrix materials were phenolic (Kynol) fibers and SiC. A new ERC proprietary matrix was used also. Graphite bipolar plates with 33% phenolic resin binder were used. Stacks were tested on hydrogen and simulated reformed methanol for up to 18,000 hours. Two 80-cell (2.1 kW) stacks and a methanol reformer were built and delivered to MERADCOM.

32144 **(DOE/ET/11319—T2) Development of molten-carbonate fuel cells for power generation. Final report, August 1977-December 1979.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Jan 1980. Contract AC02-77ET11319. 557p. NTIS, PC A24/MF A01. Order Number DE81027028.

The objectives of this research includes the development of promising concepts to circumvent a number of outstanding technical challenges in molten carbonate fuel cell technology and the better definition of the operating limits of molten carbonate fuel cells and power plant based thereupon. A central focus was the development of cell technology which would be compatible with high-efficiency, large-scale, coal-fired fuel cell power plants. The broad and comprehensive program included elements of system definition, cell and system modelling, cell component development, cell testing in pure and contaminated environments, and the first stages of technology scale-up. Single cells, with active areas of 45cm² and 582cm², were operated at 650°C and 1 atm pressure using low-Btu simulated coal-derived fuels. Cell performance was improved to state-of-the-art levels through the development of new cell design concepts and improved electrolyte and electrode components. Performance was shown to degrade by the presence of fuel contaminants, such as sulfur and chlorine, and due to changes in electrode structure. Using conventional hot-press fabrication techniques, electrolyte structures up to 20" x 20" were fabricated. Promising new approaches were developed for non-hot-pressed electrolyte structure fabrication and a promising new electrolyte matrix material was identified. This program formed the basis for a long-range effort to realize the benefits of fuel cell power plants.

32145 **(DOE/ET/11320—9) High-temperature fuel-cell research and development. Quarterly technical progress report, 1 April 1981-30 June 1981.** Lessing, P.; Johnston, M. (Montana Energy and MHD Research and Development Inst., Inc., Butte (USA)). Jul 1981. Contract AC02-77ET11320. 31p. NTIS, PC A03/MF A01. Order Number DE81028155.

Work performed during the third quarter of the contract period is described. Tasks are: (1) molten carbonate electrolyte-matrix fabrication and reinforcement using ceramic fibers; and (2) surface studies of molten carbonate interaction with various metal and ceramic fuel cell components. Results of tape casting and hot rolling experiments under various experimental conditons are reported. These results indicate tapes can be hot rolled in a single process between porous nickel electrodes and achieve densities of greater than ninety-three percent theoretical. Also reported are advancing and receding contact angles of molten (62 Li-38 $K)_2CO_3$ carbonates (pure and contaminated) on metal and ceramic substrates. Results to date indicate varying degrees of nonwetting in reducing (fuel gas) atmosphere on metal substrates. This nonwetting is a function of temperature and impurity levels. Wetting generally occurs in oxidizing atmosphere for metals and wetting occurs in reducing and oxidizing atmospheres for ceramic (metal oxide) substrates.

32146 **(DOE/ET/11320—T5) High-temperature fuel-cell research and development. Annual technical status report, October 1, 1978-September 30, 1979.** (Montana Energy and MHD Research and Development Inst., Inc., Butte (USA)). 1979. Contract AC02-77ET11320. 24p. NTIS, PC A02/MF A01. Order Number DE81026782.

The object of this program is to develop strong thin fibers of materials which are chemically and physically stable in molten carbonate fuel cell electrolyte at 600 to 700°C and to perform the materials characterization necessary to determine the stability of the fibers in the molten carbonate electrolyte. Progress is reported.

32147 **(DOE/ET/13323—T1) Overview of fuel-processing technologies for fuel-cell power generation.** (Catalytica Associates, Inc., Santa Clara, CA (USA)). 6 Nov 1978. Contract AC03-77ET13323. 133p. NTIS, PC A07/MF A01. Order Number DE81025783.

An important aspect of the development of fuel cell power generation systems is the choice of fuel processing technologies and the optimum integration of the fuel processor with the fuel cell. The study provides a comprehensive overview of existing and emerging technologies for the generation of synthesis gas from a variety of fuels of increasing complexity, ranging from naphtha to coal. These technologies are evaluated in terms of the fuel cell constraints and the technical objectives of the integrated fuel cell power generation systems. The analysis of the most promising technologies is carried out using representative fuels for each of the following fuel categories: low boiling fuels, distillate fuel oils, high boiling fuels, coal and coal liquids. The most practical technologies for these fuels are highlighted and heat and mass balances for the integated systems presented. From the analysis it is clear that as the fuels become more complex, small scale application of a fuel cell power plant become impractical and development efforts should focus on central power stations. For fuels heavier than No. 2 fuel oil, catalytic fuel processing becomes difficult and is unlikely to be practical in a fuel cell power system. Noncatalytic approaches require bottoming cycles to meet the target heat rates, increasing the complexity of the power plant.

32148 **(DOE/ET/15415—1) Electrical properties of lanthanum chromite based ceramics in hydrogen and oxidizing atmospheres at high temperatures. Final report.** Schmidt, V.H. (Montana State Univ., Bozeman (USA). Dept. of Physics). Jun 1981. Contract AS05-79ET15415. 63p. NTIS, PC A04/MF A01. Order Number DE81028306.

Several results regarding the effect of hydrogen on lanthanum chromite were determined. Thermally-activated diffusion of hydrogen through $La(Mg)CrO_3$ was found with a high activation energy. It was found that its electrical conductivity drops drastically, especially at low temperature, after exposure to hydrogen at high temperature. Also, the curvature of most of the conductivity plots, as well as the inability to observe the Hall effect, lends support to the proposal by Karim and Aldred that the small-polaron model which predicts thermally activated mobility is applicable to doped lanthanum chromite. From differential thermal analysis an apparent absorption of hydrogen near 300°C was noticed. Upon cooling the lanthanum chromite in hydrogen and subsequently reheating it in air, desorption occurred near 170°C. The immediate purpose of this study was to determine whether hydrogen has a deleterious effect on lanthanum chromite in solid oxide fuel cells.

32149 **(DOE/NASA/0201—3) Evaluation of distributed gas cooling of pressurized PAFC for utility power generation. Third quarterly report, March 1981-May 1981.** Farooque, M.; Maru, H.; Skok, A. (Energy Research Corp., Danbury, CT (USA)). May 1981. Contract AI01-80ET17088. 35p. NTIS, PC A03/MF A01. Order Number DE81025734.

The objective of this program is to provide a proof-of-concept test of a gas-cooled pressurized phosphoric acid fuel cell (PAFC). After initial feasibility tests in shorter stacks, two 10 kW stacks will be tested. Significant progress includes: (1) establishment of baseline pressurized performance, simple pressurization technique, and pressure effect on temperature profiles and pressure drops; and (2) analyses and subsequent identification of the optimum gas cooling geometry for pressurized fuel cells.

32150 **(DOE/NASA/12726—9) NASA Redox system development project status.** Nice, A.W. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1981. Contract AI04-80AL12726. 18p. (NASA-TM—82655; CONF-810642—6). NTIS, PC A02/MF A01. Order Number DE81028112.

From 4. DOE battery and electrochemical contractor's conference; Washington, DC, USA (2 Jun 1981).

NASA-Redox energy storage systems are being developed for solar power applications and utility load leveling applications by the Lewis Research Center for the Department of Energy. The major objective of the project is to establish the technology readiness of Redox energy storage for transfer to industry for product development and commercialization by industry. The approach is to competitively contract to design, build, and test Redox systems progressively from preprototype to prototype multikW and megawatt systems and conduct supporting technology advancement tasks. The Redox electrode and membrane have been shown to be fully adequate for multikW solar related applications and the viability of the Redox system technology has been demonstrated for multikW solar related applications. The status of the NASA Redox Storage System Project is described along with the goals and objectives of the project elements.

32151 **(PB—81-800021) Hydrocarbon fuel cells. 1967-July, 1980 (citations from the American Petroleum Institute Data Base). Report for 1967-July 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 135p. NTIS PC N01/MF N01.

This bibliography cites worldwide research on hydrocarbon fuel cells. The citations cover applications, design, performance, fabrication, catalysts, and electrochemistry. (This updated bibliography contains 130 citations, 2 of which are new entries to the previous edition.)

32152 **(SRD—78-086) Development of molten-carbonate fuel cells for power generation. Quarterly progress report, 15 February 1978-15 May 1978.** (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Jun 1978. Contract AC02-77ET11319. 128p. NTIS, PC A07/MF A01. Order Number DE81026173.

The objectives of this Phase I effort include the development of promising concepts to circumvent a number of outstanding technical challenges in molten carbonate fuel cell technology and the better definition of the operating limits of molten carbonate fuel cells and power plants based thereupon. Emphasis during the third quarter of the program has shifted from the procurement and construction stages to experimental cell testing. Experimental molten carbonate fuel cells have been operated using cells and components designed and fabricated by General Electric. Systems studies have focused on the contaminant and clean-up problems associated with

integrated coal-gasifier/molten carbonate fuel cell systems. Specific accomplishments include the operation of 3" x 3" molten carbonate fuel cells using fuels which are representative of an air-blown coal gasifier product. One such cell has been operated with up to 100 ppM H_2S as a fuel contaminant. Nickel electrodes have been fabricated by powder sintering; these electrodes have been characterized by porosimetry and microscopy and operated in cells. The electrolyte tile effort was focused on building an inventory of workable tiles prepared by conventional powder preparation and hot-pressing; tiles up to 10 1/2" square have been pressed.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

32153 Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980). 222p. (CONF-8003140—). $7.00.

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

Fifteen papers were presented at the meeting. A separate abstract was prepared for each paper. (LCL)

32154 Common sense approach to conservation. Nath, K.R. pp 95-103 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

An attempt is made to present a method to make a plant more efficient and improve profitability. The basic premise presented is that for every potential benefit there is a cost associated with the benefit. Efforts concerning conservation discussed include capital expenditures, non-capital expenditures, and people. (MCW)

3201 Buildings

REFER ALSO TO CITATION(S) 31585, 31838, 31871, 32405

32155 (AD-A—089262) Sea/lake water air conditioning at Naval facilities. Final report, October 1978-December 1979. Ciani, J.B. (Civil Engineering Lab. (Navy), Port Hueneme, CA (USA)). May 1980. 23p. NTIS, PC A02/MF A01.

The sea/lake water air conditioning (AC) work at CEL and related efforts by others are summarized, along with annotated references. Computer models for estimating the capital costs and energy use for sea/lake water air conditioning (AC) systems are introduced, and the output from these models exercised on two Naval facilities are presented. It was found that (1) the computer models produced reasonable estimates of the capital cost and energy use of seawater AC systems; (2) the capital cost and energy use of such systems are sensitive to the pipeline length, which is dependent on the seawater temperature near the seafloor; (3) at a hypothetical typical Naval facility represented by the average of the two trial facilities, seawater AC requires 80% less energy than conventional AC, but the capital cost of seawater AC is 60% greater; and (4) at this typical facility the life cycle cost for seawater AC is 25% less than that of conventional AC. Sea/lake water AC is recommended for consideration as an alternative to conventional AC at Naval facilities that adjoin bodies of water, and it is also recommended that the computer models be used to make estimates of the capital cost and energy use of sea or lake water AC systems.

32156 (AD-A—089406) Parametric analysis of energy consumption in army buildings by the Building Loads Analysis and System Thermodynamics (BLAST) computer program. Final report. Windingland, L.M. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Aug 1980. 41p. NTIS, PC A03/MF A01.

This report describes the effects varying architectural, construction, and mechanical system features have on the energy consumption of three Army buildings: a barracks, an administration building, and a dental clinic. The three buildings were simulated for five climatological regions centered at Washington, DC; Charleston, SC; Los Angeles, CA; Columbia, MO; and Fort Worth, TX. Energy consumption simulations were done by the Building Loads Analysis and System Thermodynamics (BLAST) computer program. The report shows the percentage difference in annual heating and cooling energy use for three buildings and five locations when variations from the as built insulation levels, orientation, window areas, window types, infilitration levels, mechanical system, and system control strategies are used. It was concluded that insulation levels, window size and type, and infiltration/ventilation rates are the most important architectural and construction features affecting the degree of energy consumption, and that proper selection of mechanical system type and system control strategies can reduce annual energy consumption by up to 50 percent.

32157 (DOE/CE/20057—1) Bibliography on available computer programs in the general area of heating, refrigerating, air conditioning, and ventilating. Howell, R.H.; Sauer, H.J. Jr. (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York). Jul 1980. Contract AC01-78CS20057. 255p. NTIS, PC A12/MF A01. Order Number DE81029836.

A bibliography of available computer programs (216) in the areas of heating, refrigerating, air conditioning, and ventilating is presented. Information provided for each code includes purpose; key words; description; input requirements; program outputs; program language; system compatibility; developer; and availability. Codes are presented in the following areas: heating and/or cooling load calculation programs (37); energy analysis programs (43); duct design programs (15); piping design programs (15); equipment selection and/or simulation programs (19); solar programs (30); heat transfer analysis programs (10); economic analysis programs (9); illumination programs (7); fire protection programs (6); property calculation programs (5); psychrometric analysis programs (5); acoustics programs (3); and 12 miscellaneous programs. (MCW)

32158 (DOE/CS/30254—4) Continuing development of the DEROB system. Quarterly report, April 1, 1981-June 30, 1981. Francisco, A.N. (Texas Univ., Austin (USA). School of Architecture). Jun 1981. Contract AC02-80CS30254. 100p. NTIS, PC A05/MF A01. Order Number DE81027971.

The daylighting sky factors have been calculated for an arbitrary point. The point represents a light meter that can be located anywhere in the simulated structure, and it can be oriented in any direction desired. It reads the sky factor and it can disaggregate the first incidence component from the contributions due to reflections from surfaces, and transmissions from other spaces. The reflected and transmitted components show a marked spatial dependence. The results are compared with standard calculation methods. These standard calculation methods are not capable of discerning the spatial dependence, and they have no capability to account for transmissions from other spaces. The fact that DEROB can describe in detail multispatial interactions allows it to calculate the effect of light-wells, courtyards, solariums on the illumination pattern of simulated spaces. The report includes a description of the results of the first set of comparisons, as well as the mathematical theory for multispace coupling.

32159 (DOE/R5/10248—T2) Earth sheltered industrial/utility park. Final report. (Cumberland Development Corp., WI (USA)). Apr 1981. Contract FG02-80R510248. 79p. NTIS, PC A05/MF A01. Order Number DE81025551.

A proposed industrial park in Cumberland, Wisconsin is discussed. Planners identified 4 land use elements for the site. A concept feasibility study for the earth-covered industrial park, an analysis of energy flows within the Cumberland community, and a resource and technology assessment of biomass feedstocks for a possible community scale bioenergy facility are discussed. (MCW)

32160 (DOE/TIC—1027975) Pressurization test results: Bonneville Power Administration Energy Conservation Study. Final report. Krinkel, D.L.; Dickeroff, D.J.; Casey, J.; Grimsrud, D.T. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01. Order Number DE81027975.

Infiltration of air into (and out of) buildings is a phenomenon that has long been recognized as a significant source of space con-

ditioning energy loss. Because the phenomenon is so complex, however, it has generally not been possible to calculate the losses with satisfactory accuracy. Infiltration tests were performed via pressurization and depressurization of the 18 houses in the Midway Substation Residential Community, both before and after weatherizing them. The infiltration tests were thus made an integral part of the Midway Energy Conservation Study. It was found that adding insulation did not affect infiltration rate, but that adding strom windows and doors reduced it about 17 percent.

32161 (LBL—12300) Theoretical basis of the DOE-2 building energy-use analysis program. Curtis, R.B. (Lawrence Berkeley Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 15p. (CONF-810423—7). NTIS, PC A02/MF A01. Order Number DE81028896.

From 1. International Energy Agency (IEA) conference on new energy conservation technologies and their commercialization; Berlin, F.R. Germany (6 Apr 1981).

The purpose of the DOE-2 project has been to create, test, document, and maintain a user-oriented, public domain, computer program, that will enable architects and engineers to perform design and retrofit studies of the energy-use of buildings under realistic weather conditions. This purpose has been met and the latest version, DOE-2.1A, of the program has been named by the US DOE as the Standard Evaluation Technique (SET) for the Congressionally mandated Building Energy Performance Standards (BEPS). In fulfilling this purpose a number of program design decisions have been made that determine the breadth of applicability of DOE-2.1. Such design decisions are intrinsic to all building energy-use analysis computer programs and determine the types of buildings or the kind of HVAC systems that can be modeled. In particular, the weighting factor method used in DOE-2 has both advantages and disadvantages relative to other computer programs. Users should be aware of the domain of applicability of DOE-2.1 and other available programs.

32162 (LBL—12461) Energy savings with solid-state ballasts in a V.A. hospital. Verderber, R.R.; Morse, O.; Arthur, A.; Rubinstein, F. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 14p. (CONF-811017—2). NTIS, PC A02/MF A01. Order Number DE81025207.

From IEEE/IAS annual meeting; Philadelphia, PA, USA (5 Oct 1981).

More than two hundred solid-state fluorescent ballasts were installed in representative areas of a Veterans Administration Hospital in Long Beach, California, to determine the cost-effectiveness of such an installation. The power and illumination levels in the test sites were measured first as they initiallly existed, then after the fixtures were cleaned and relamped with energy-savig fluorescent lamps, and finally after the core-coil ballasts were replaced with solid-state ballasts. The annual energy savings for the complete retrofit was measured as 33.9%. In the director's suite natural daylight was used to supplement the electrical illumination, providing and additional 20 to 25% energy savings. Thus in that area, the total annual energy saving amounted to 48%. All of the measured data are analyzed on the basis of life-cycle costing. The analyses are presented on sets of curves relating the cost-effective price of a ballast to the cost of electrical energy.

32163 (LBL—12462) Electromagnetic interference (EMI) measuremenets of fluorescent lamps operated with solid-state ballasts. Arthur, A.; Verderber, R.; Rubinstein, F.; Morse, O. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 9p. (CONF-811017—1). NTIS, PC A02/MF A01. Order Number DE81025218.

From IEEE/IAS annual meeting; Philadelphia, PA, USA (5 Oct 1981).

Solid-state ballasts were placed in fluorescent lamps in various areas of a hospital to determine if these high-frequency systems would adversely affect any hospital operations. The general areas tested included a lobby and an office space. Potentially sensitive areas containing hospital diagnostic and monitoring equipment, including a computerized axial tomography (CAT) scanning room, an electroencephalograph (EEG) examination room, and a coronary ward were also tested. The measurement techniques are described and the results discussed with respect to the existing RFI environment and with respect to EMI radiated and conducted limits specified by the Federal Communications Commission and the Federal Drug Administration.

32164 (LBL—12599) Daylighting calculations for nonrectangular interior spaces with shading devices. Modest, M.F. (Lawrence Berkeley Lab., CA (USA); University of Southern California, Los Angeles (USA). Dept. of Mechanical Engineering). Jun 1981. Contract W-7405-ENG-48. 35p. (CONF-810862—1). NTIS, PC A03/MF A01. Order Number DE81027962.

From Illuminating Engineering Society annual technical conference; Toronto, Canada (9 Aug 1981).

Employing a general numerical model for the calculation of daylighting in interior spaces the sensitivity of daylighting to nonrectangular rooms, such as L-shaped rooms, and to other internal visual obstructions, such as light-shelves, is discussed. In addition, the model has been expanded to allow the treatment of opaque, semi-transparent, and translucent window overhangs, which may be positioned at any or all sides of a window. Further, the model has now the capability of graphical output. Thus, all results are shown in the form of contour plots, showing room outline, sunny areas, and constant-illumination or constant-daylight factor lines.

32165 (LBL—12862) Potential energy savings in the residential sector of the United States. Ingersoll, J. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 11p. (CONF-811006—3). NTIS, PC A02/MF A01. Order Number DE81028873.

From International conference on energy use management--III; West Berlin, F.R. Germany (26 Oct 1981).

The state-of-the art computer program, DOE 2.1, was used to simulate the hour-by-hour thermal performance of residential buildings in the four major climate zones of the United States, and a life-cycle cost analysis was applied to determine the optimal energy requirement of a typical house demonstrate that present levels of energy consumption can be reduced by a factor of two without compromising health and comfort standards. Within present technology, additional energy savings can be achieved but not yet in a cost-effective way.

32166 (MASEC-CF—81-038) Seminars for private college administrators on solar applications for college buildings. (Mid-American Solar Energy Complex, Minneapolis, MN (USA)). Jun 1981. Contract AC02-79CS30150. 8p. NTIS, PC A02/MF A01. Order Number DE81027981.

The objective of this project was to increase the working knowledge of key private college decision makers on passive and active solar fundamentals, proven passive and active technology, and conservation means integral to these technologies in the renovation of college buildings or their energy systems, to be achieved by conducting a series of three seminars. A summary of the project activities and a brief summary of workshop evaluations are given. (MCW)

32167 (NYSERDA—80-27) Energy conservation in museums. Ucar, M.; Doering, G.C. (Syracuse Univ., NY (USA). Inst. for Energy Research). Jul 1980. 172p. New York State Energy Research and Development Authority, Albany. Order Number DE81903901.

An overall assessment of energy conservation in museums in New York is made in view of the special environmental considerations involved. The special relative humidity, temperature, and lighting requirements of museums were studied extensively. An energy consumption data base was formed with actual energy use data obtained from over fifty institutions across the state. The computerized energy consumption data base compiled covers an extremely wide range of energy usage levels. On-site energy consumption ranged from approximately 20,000 to 400,000 Btu/ft^2 year. The data base includes small rural institutions and large metropolitan museums, historic and modern structures, seasonal and year-round museums, single buildings and collections of buildings, single-story buildings and multiple-story buildings, an aquarium, and a zoo. Thus, it is difficult to identify trends in the energy consumption data and to make correlations with such parameters as age, type, size, etc. Walk-through or mini energy audits were per-

formed on ten museums located in various parts of New York State. This project also included a thorough study of all potential funding sources to which museums can apply for financing energy conservation measures. Sources of technical assistance and information were also identified. (MCW)

32168 **(PB—81-106932) The administrative feasibility of a mandatory program for residential energy conservation.** Dubinsky, R.; Rosenblatt, J. (Urban Inst., Washington, DC (USA)). Jun 1980. Contract HUD-H-2882. 216p. NTIS, PC A10/MF A01.

This report is one of four Urban Institute reports evaluating the feasibility of a mandatory program which requires that residential dwellings meet an energy standard at the time the properties are sold or exchanged. It covers the feasibility and cost of various administrative options which might be implemented to carry out such a mandatory program nationwide.

32169 **(PB—81-106957) The impact of residential energy conservation standards on households.** Andreassi, M.; Yap, L.; Lee, O. (Urban Inst., Washington, DC (USA)). Jun 1980. Contract HUD-H-2882. 181p. NTIS, PC A09/MF A01.

This report is one of four Urban Institute reports evaluating the feasibility of a mandatory program which requires that residential dwellings meet an energy standard at the time the property is sold or transferred. Three illustrative energy-efficiency standards (low, medium, high) which represented different levels of conservation were developed.

32170 **(PB—81-106965) The effects of energy conservation standards on housing markets.** Weicher, J.C. (Urban Inst., Washington, DC (USA)). Jun 1980. Contract HUD-H-2882. 75p. NTIS, PC A04/MF A01.

This report analyzes the housing market impacts of mandotory energy conservation standards for owner-occupied homes, focusing on standards for existing homes imposed at the time of sale. Beginning with an analysis of the effects of energy price increases in the absence of any standards, the paper then lists several ways in which standards might affect the housing market and investigates these issues both theoretically and quantitatively.

32171 **(PB—81-106981) Residential energy efficiency standards study. Technical analysis.** (National Inst. of Building Sciences, Washington, DC (USA)). Jun 1980. Contract HUD-HC-5040. 370p. NTIS, PC A16/MF A01.

This report determines the need for, the feasibility of, and the problems of requiring, by mandatory Federal action, that all residential dwelling units meet applicable energy efficiency standards. The analysis identified the potential requirements of mandatory energy efficiency standards, estimated the incremental energy savings and investment cost of mandatory standards for 1981 through 1990, and assessed the impact of the estimated, maximum incremental energy savings and investment cost of standards on the entire economy.

32172 **(PB—81-125197) Heat savings by insulation and usage of the heating system achieved in two houses.** Bouwman, H.G. (Instituut voor Milieuhygiene en Gezondheidstechniek TNO, Delft (Netherlands)). Jun 1976. 26p. (In Dutch). NTIS, PC A03/MF A01.

Heat savings were determined for each of the following actions: heating with a lower temperature; closed curtains; shut off radiators; insulation in hollow walls; and double windows. The only information which was used was gas meter reading, temperature measurements, and meteorological data, mainly day degree information from the Bilt (National Meteorological Institute). Total savings exceeded more than 40%.

32173 **(PB—81-851032) Heat exchangers for space heating. January, 1976-September, 1980 (citations from the Energy Data Base). Report for Jan 76-Sep 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Sep 1980. 128p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the applications of various types of heat exchangers found in many types of heating systems to the heating of both domestic and commercial space. (Contains 128 citations.)

32174 **(SAI—1-026-79-907-LJ) Study of dual-stage pilot systems for ranges and ovens.** (Science Applications, Inc., La Jolla, CA (USA)). 12 Oct 1979. Contract AC03-79CS10757. 19p. NTIS, PC A02/MF A01.

An evaluation was made of the energy saving potential of standing gas pilot light systems for residential ranges and ovens. The purpose of the study was to determine the cost effectiveness of dual stage pilot lights which utilize a hypodermic pilot for standby operation and a larger flow rate pilot light during oven operation. A life-cycle analysis was performed based upon the estimated annual energy savings and the estimated first cost of such a device. No information was available to determine the incremental maintenance cost, however, hypodermic pilots are currently in use on some cooktop units with no apparent increase in maintenance cost. The incremental maintenance cost was therefore assumed to be zero.

32175 **Generation, utilization and conservation of energy.** Ridenour, S. (Temple Univ., Philadelphia, PA). pp 53-57 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

From 2. annual energy seminar; Erie, PA, USA (31 Mar 1980).

A student-oriented Bin-method energy analysis program (BEAPS) was developed and used in a study to show that computer-aided energy analysis in buildings enhances a student's comprehension and prediction accuracy of energy consumption in buildings.

3202 Transportation

REFER ALSO TO CITATION(S) 32200, 32202, 32203, 32383

32176 **(DOE/CS/50004—T3) Test plan for reliability fleet testing of alcohol/gasoline blends.** (Southwest Research Inst., San Antonio, TX (USA). Mobile Energy Div.). Sep 1979. Contract AC03-79CS50004. 17p. NTIS, PC A02/MF A01.

The Alternative Fuels Utilization Program (AFUP) addresses several options as petroleum replacements for highway vehicles. At this time, the AFUP effort is concentrating on alcohol fuels with the goal of bringing the end-use technology for alcohol/gasoline blends to the point of commercial readiness by 1982-83. This Test Plan covers the operational and reporting procedures associated with the fleet vehicles and supporting facilities, the latter encompassing both the garage/fueling complex and the emissions/fuel economy test facility. The operational instructions and requirements provide for pretest and daily fleet activities; vehicle maintenance and replacement; fuel surveillance; and dynamometer testing for emissions and fuel economy on a chassis dynamometer.

32177 **(DOE/CS/50069—T1) Responses to comments of air transport association of America on aircraft towing feasibility study.** (Peat, Marwick, Mitchell and Co., San Francisco, CA (USA)). Jun 1981. Contract AC01-79CS50069. 112p. NTIS, PC A06/MF A01. Order Number DE81029834.

A preliminary assessment of the constraints on and feasibility of extended aircraft towing between airport runways and terminal gate areas with engines shutdown is made. Past aircraft towing experience and the state-of-the-art in towing equipment are reviewed. Safety and operational concerns associated with aircraft towing are identified, and the benefits and costs of implementing aircraft towing at 20 major US airports are analyzed. It was concluded that extended aircraft towing is technically feasible and that substantial reductions in aircraft fuel consumption and air pollutant emissions can be achieved through its implementation. It was also concluded that, although capital and operating costs associated with towing would be increased, net savings could generally be attained at these airports. Because of the lack of past experience and the necessity of proving the cost effectiveness of towing concept, a demonstration of the feasibility of large-scale aircraft towing is necessary. The study evaluates the suitability of the 20 study airports as potential

demonstration site and makes recommendations for the first demonstration project.

32178 (DOE/CS/50141—T1) Analysis of integrated fuel-efficient, low-noise procedures in terminal-area operations. McKinley, J.B. (Systems Control, Inc., Palo Alto, CA (USA). Aeronautical and Marine Systems Sector; Systems Control, Inc., West Palm Beach, FL (USA). Champlain Technology Industries Div.). Jan 1981. Contract AC01-80CS50141. 125p. NTIS, PC A06/MF A01. Order Number DE81029833.

The specific aviation energy conservation issues, terminal area fuel conservation and airport noise level relationships, are investigated. The first objective of the study was to quantify the potential fuel savings and noise level reduction in the Los Angeles International (LAX) terminal area between 1980 and 1990 attributable to compliance with the noise requirements of FAR Part 36. These savings will be due to the retiring, retrofiting, and re-engining of older narrow-body aircraft (DC-8, B707, etc.) and the growth of wide body aircraft operations (DC-10, B747, B767, etc.). The second objective was to determine what current noise abatement procedures could be relaxed without adversely impacting current (1980) noise levels, and at the same time conserving additional fuel. To accomplish these objectives, two FAA computer models were used. The Integrated Noise Model (INM) Version 2.7, was used for noise analysis, and LINKMOD, a preliminary fuel burn model, for the fuel analysis. The results of this detailed analysis revealed that due to the changing aircraft mix at LAX to include more wide body aircraft and fewer narrow body aircraft operations, airport noise level will decrease by 8.5 and 9.2 square miles on the 75 Ldn contour for 1985 and 1990, respectively, from the 1980 baseline.

32179 (DOE/CS/51175—T19) Evaluation of alternatives for recovery of the water jacket heat of diesel-powered marine vessels. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA). Transportation Consulting Div.). Mar 1979. Contract AC03-76CS51175. 75p. NTIS, PC A04/MF A01. Order Number DE81028407.

The results of an investigation of systems to recover and utilize the waste heat from the water jacket of marine diesel engines are described. The approach to the study and a summary of the results are presented in Chapter I. Chapter II discusses the evaluation and selection of uses of the waier jacket heat; and selection of the systems in a three-step process: selection of vessel types which are most suitable for heat recovery systems; identification; evaluation; and selection of uses of the water jacket heat; and selection of system and method to recover the heat. It is concluded that the Rankine-cycle system is the most promising water jacket heat recovery system. Chapter III presents an analysis of the economic feasibility of the recovery system in two discussions: parametric breakeven cost analysis to determine economic feasibility and expected rate of return on investment analysis. (MCW)

32180 (EMD—81-52) Department of Energy should provide leadership to assure near-term gasoline-conservation opportunities are realized. (General Accounting Office, Washington, DC (USA)). 13 Apr 1981. 33p. General Accounting Office, Gaithersburg, MD. Order Number DE81904049.

The Department of Energy's programs that promote gasoline savings by educating drivers about these conservation opportunities were examined. The methodology employed to review the program is described. Chapter 2 discusses the decline in gasoline consumption and Chapter 3 discusses directions needed to guide development of DOE's near-term gasoline conservation programs. It is recommended that the Secretary of Energy develop a comprehensive strategy to guide DOE's gasoline conservation efforts. (MCW)

32181 (PB—81-130767) Measurement of fuel consumption on country roads: study of effects of different road and traffic situations. Hammarstroem, U. (Statens vaeg- och Trafikinstitut, Linkoeping (Sweden)). 1979. 61p. (In Swedish). NTIS, PC A04/MF A01.

Fuel-consumption in motor-vehicles has been examined in different road and traffic conditions. Field-measurements with a car on rural roads has resulted in connections between fuel-consumption and the following variables: speed, gradient, horizontal curvature, pavement and queue position. For lorries the effect of gradient on fuel consumption was examined by means of a calculation-model. The model was used for calculating fuel consumption for various weight, speed and gradient.

32182 (PB—81-129090) Research on energy conservation for cars and goods vehicles. Waters, M.H.L. (Transport and Road Research Lab., Crowthorne (UK)). [nd]. 34p. NTIS, PC A03/MF A01.

This paper is a summary of published work carried out by TRRL on energy conservation for cars and goods vehicles. It describes the research techniques, gives some results and indicates the practical use that can be made of the research work. It also examines briefly the prospects for road transport fuel in the future when natural oil is so scarce and expensive that substitute fuel will be needed.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 31543, 31775, 31935, 31936, 32089, 32125, 32550

32183 (AD-A—092620) Research and development of an on-line cavitating emulsifier for the reduction of specific fuel consumption and emission products in US Navy vessels. Final report. Parker, J.T. II; Thiruvengadam, A.P. (Daedalean Associates, Inc., Woodbine, MD (USA)). Oct 1980. Contract N00014-79-C-0084. 98p. NTIS, PC A05/MF A01.

The objective of this program was to perform the research necessary to design, develop, test and evaluate an on-line cavitating emulsification system to determine the fuel saving and emission control potential for U.S. Navy vessels. The advantages of a cavitating emulsifier were the reduction of the energy required to produce the emulsion, the reduction of the size and weight of the equipment, and on-line production capability. In addition, cavitating emulsification technology could be applied to more than one type of combustion system. All of the test combustion systems were fueled by an on-line emulsification system which produces only the amount of emulsion required by the combustion device. The on-line cavitating emulsifier has shown potential for significant reductions in fuel consumption while being able to produce emulsions efficiently at existing system fuel line pressures. This document addresses all of the development and testing completed to date.

32184 (DOE/CS/40059—T1) Development of a biomass energy system for drying corn. Final report, 1 July 1978-30 June 1981 . Buchele, W.F.; Claar, P.W. II; Marley, S.J. (Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Agricultural Engineering). 1981. Contract AS02-78CS40059. 109p. (COO—4916). NTIS, PC A06/MF A01. Order Number DE81029027.

Over a 3 year period, research has been conducted on the development of a direct-combustion furnace for burning agricultural crop residue. This report summarizes the progress that has been made. During this time period, the following research efforts have been carried out: (1) evaluation of the design and operating parameters of the Iowa State University Agricultural Engineering incinerator-type furnace; (2) evaluation of existing furnace types for application to burning agricultural crop residue; (3) design and fabrication of a direct-combustion, biomass-fueled furnace; (4) evaluation of the direct-combustion, biomass-fueled furnace; (5) redesign and fabrication of a second direct-combustion, biomass-fueled furnace; (6) evaluation of the second direct-combustion, biomass-fueled furnace; (7) redesign and fabrication of a third direct-combustion, biomass-fueled furnace; (8) cooperation with manufacturers for marketing furnaces for farmstead applications; (9) economic and energy analysis for the utilization of agricultural crop residue on a cornbelt farm; and (10) determination of the quantitites of corn residues produced on a cornbelt farm and the effect of residue removal harvest rates on the amount of cover remaining and the resulting impact on soil erosion hazards.

32185 (DOE/CS/40212—T1) Energy conservation in false twist texturing. Final report. Kang, T.J.; Kimrey, H.D.; Seyam, A.M.; Kaufman, F.; El-Shiekh, A. (North Carolina State Univ., Raleigh (USA). School of Textiles). Apr 1981. Contract AS05-79CS40212. 14p. NTIS, PC A02/MF A01. Order Number DE81028114.

The feasibility of using heating techniques other than contact electric heating to heat filament yarns during the False Twist Texturing Process is investigated. Laser, microwave, and infrared radiation heating are investigated. A summary of a paper, A Study of Microwave Texturing of Polyester Yarns, is included in the publication. (MCW)

32186 (DOE/ET/15426—T6) Report No. 1380-1. R & D for improved-efficiency small steam turbines. Phase I. Technical progress report, April 1979-September 1979. (Northern Research and Engineering Corp., Cambridge, MA (USA)). Oct 1979. Contract AC02-79ET15426. 106p. NTIS, PC A06/MF A01. Order Number DE81026760.

The overall objective of this program is to develop a class of high efficiency steam turbines that will replace the current machines in the low power range. Considerable energy savings are anticipated. This report describes the initial effort which was made to meet this objective. This included identification and interpretation of the small (500 to 5000 hp) steam turbine market and market trends and, based on this investigation, the definition of the preliminary radial inflow turbine (RIT) design configurations optimally suited to penetrate a significant portion of this market by the year 1985. To this end, sales data was compiled through a literature search and a turbine user survey and was analyzed to provide the basis for setting design goals. This included a determination of current turbine performance, establishment of an optimum design point, and definition of the range of operating conditions over which to evaluate the performance of the possible RIT configurations. In addition, parametric studies were made to determine the configurations which exhibit the optimum combination of high performance and minimum standard part requirements. These were analyzed to predict design-point and off-design performance and to estimate frame and unit sizes. Preliminary design of the final configuration and market penetration predictions have been initiated.

32187 (DOE/TIC—11486) Environmental assessment on industrial cogeneration demonstration plant at the Riegel Textile Mill site, Ware Shoals, South Carolina. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-38. 74p. NTIS, PC A04/MF A01. Order Number DE81030179.

The paper examines the potential environmental, health and safety, and socioeconomic impacts of the proposed industrial cogeneration demonstration plant at the Riegel Textile Corporation's mill in Ware Shoals, South Carolina. The proposal involves installing and demonstrating cogeneration of process steam and electricity by topping process steam. Section I discusses the need and purpose for the proposal. Section II discusses alternatives including the proposed action. Alternatives including the proposed cogeneration system discussed are no action; replacement of one existing boiler, omitting cogeneration; system alternatives (cogeneration bottoming cycles, alternative cogeneration topping cycles. Section III provides past and present data on those aspects of the local environment which could be affected by the proposed actions. Items discussed are topography and climatology, geology and oils; air quality; water resources and quality; ecological resources; land use plans and policies; socioeconomic setting; health and safety; utilities and services; energy resources; cultural resources and aesthetics and details on these items are presented in Section IV. A summary of impacts associated with, impact of alternatives to, and mitigating measures to the proposed action are also presented in Section IV. Discussions on unavoidable adverse environmental effects; irreversible and irretrievable commitment of resources; relationship of land use plans, policies, and controls; and relationship between short-term use of environment and maintenance and enhancement of long-term productivity conclude Section IV. (MCW)

32188 (DOE/TIC—11487) Environmental assessment and industrial cogeneration demonstration plant at the Hoffmann-La Roche Plant Site, Belvidere, New Jersey. (Argonne National Lab., IL (USA)). Jul 1981. Contract W-31-109-ENG-38. 128p. NTIS, PC A07/MF A01. Order Number DE81030180.

This environmental assessment (EA) examines the potential environmental, health and safety, and socioeconomic impacts of the proposed industrial cogeneration demonstration plant at the Hoffmann-La Roche (H-LR) Belvidere property in White Township of Warren County, New Jersey. The proposed cogeneration system consisting of a slow-speed, two-stroke 23,300 kW Sulzer diesel engine which powers a 13.8 kV generator will satisfy all electrical demands of the plant and will produce steam for plant process operations. The need and purpose of the proposed action are discussed in Section I. An alternative plan of no action was considered along with the proposed cogeneration plan in Section 2. Section 3 presents a detailed description of the existing environment and Section 4 comprises the results of the analytical effort to assess the environmental impact of the proposed action. Impacts associated with the proposed action on topography and climatology, geology and soils, air quality, water resources and quality, ecological resources, socioeconomics, land use plans and policies, health and safety, utilities and services, energy resources, and cultural resources and aesthetics are detailed in Section 4. Based on the analysis and findings on the potential environmental impacts from the proposed action, the operation of the proposed industrial cogeneration demonstration project on No. 6 fuel oil asits primary energy source will have no significant impact on the human and natural environments. Any potential environmental impacts will be mitigated by application of appropriate control technology and related measures specified in Section 4. (MCW)

32189 (PB—81-103814) National Recycling Research Agenda Project for the National Science Foundation, San Francisco, California and Washington, DC. Final report, November-December 1979. Seldman, N.N. (Institute for Local Self Reliance, Washington, DC (USA). Waste Utilization Div.). Mar 1980. 128p. NTIS, PC A07/MF A01.

The project was convened in order to address the requirements of a Federal R and D investment program which would encourage a diversified approach to a wide array of material and energy recovery technologies, allowing local governments, private enterprise, and citizens to reap the full potential from its solid waste management institutions. Over 150 individuals who responded to the announcements were asked to provide resumes and to address nine problem areas relating to resource recovery technology development. They are as follows: markets for secondary materials; compatibility of recycling (materials recovery) and combustion (energy recovery); technology and equipment development; project initiation; waste (source) reduction; participation; institutional barriers; hazardous waste; and waste utilization.

32190 (PB—81-127557) Investigation of factors affecting energy for irrigation pumping. Technical completion report. Barefoot, A.D. (Oklahoma State Univ., Stillwater (USA). Dept. of Agricultural Engineering). Sep 1980. Contract DI-14-34-0001-8038. 16p. NTIS, PC A02/MF A01.

Operation efficiency was evaluated for 19 irrigation pumping plants covering five counties in Oklahoma. Most were operated using natural gas; a few using electricity. Most of the irrigation pumps tested were found to be operating at fairly high efficiency levels. Average pump efficiency was found to be about 62 percent. Improved matching of engines to pumps and pumps to well conditions would, in the long term, help reduce irrigation energy use.

32191 (PB—81-132227) Military wastes-to-energy applications. Final report for FY 1979-80. Kawaoka, K.E. (Aerospace Corp., Germantown, MD (USA)). Nov 1980. 200p. NTIS, PC A09/MF A01.

This analysis focuses on the military waste material and by-product stream and the potential for energy recovery and utilization. Feedstock material includes municipal-type solid waste, selected installation hazardous waste, and biomass residue. The study objectives are to (1) analyze the characteristics of the military waste stream, (2) identify potential energy recovery options, and (3) ex-

amine and assess the technical and economic feasibility and environmental and institutional impacts of various energy recovery approaches.

32192 (SERI/TR—733-79OR(Vol.1)) Energy end-use requirements in manufacturing. Limaye, D.R.; Isser, S.; Beatty, R.; Colville, G.; Lang, K.; Krawiec, F. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 233p. NTIS, PC A11/MF A01. Order Number DE81028975.

This three volume report examines energy end-use requirements and cost employed to characterize typical applications and resultant services in the US and state manufacturing subsectors in 1977 and 1990. A review and evaluation of existing industrial energy data bases were undertaken to assess their potential for supporting SERI research to analyze technical and economic feasibility of solar technologies, and to establish multiyear R & D programs for: (1) solar thermal industrial electric power sytems and (2) solar IPH systems. In the review of existing industrial energy data bases, the level of detail, disaggregation, and primary sources of information were examined. The focus was on fuels and electric energy used for heat and power purchased by the manufacturing subsector and listed by 2-, 3-, and 4-digit SIC, primary fuel, and end use. Projections of state level energy prices to 1990 were developed and presented by using the energy intensity approach. The effects of federal and state industrial energy conservation programs on future industrial sector demands were assessed. Current (1977) and future (1990) energy end-use requirements in manufacturing were developed for each 4-digit SIC industry and were grouped as follows: (1) hot water; (2) steam (212° to 300°F, each 100°F interval from 300° to 1000°F, and greater than 100°F), and (3) hot air (100°F intervals). Volume I details the activities performed in this effort.

32193 (SERI/TR—733-79OR(Vol.2)) Energyend-use requirements in manufacturing. Limaye, D.R.; Isser, S.; Beatty, R.; Colville, G.; Lang, K.; Krawiec, F.;. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 624p. NTIS, PC A99/MF A01. Order Number DE81027973.

Volume II presents data on the US and state manufacturing subsectors' energy end-use requirements disaggregated by 2- and 4-digit SIC and temperature level in 1977.

32194 (SERI/TR—733-79OR(Vol.3)) Energy end-use requirements in manufacturing. Krawiec, F.; Limaye, D.R.; Isser, S.; Beatty, R.; Colville, G.; Krawiec, F. Lang, K. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1981. Contract AC02-77CH00178. 624p. NTIS, PC A99/MF A01. Order Number DE81027976.

Volume III presents data on the US and state manufacturing subsectors' energy end-use requirements disaggregated by 2- and 4-digit SIC and temperature level in 1990.

32195 Natural gas replacement in the steel industry. Jordan, R.K. pp 145-150 of Proceedings of second annual energy seminar. Erie, PA; Gannon University (1980).

A review of natural gas uses in the soaking pits, reheat furnaces, tempering and blast furnaces in the steel industry is presented. It is suggested that neither syn-gas or Alaskan pipelined gas will be cheap when projecting a price of $40/bbl of imported crude oil for 1985, or about $6/MM Btu's (the equivalent of 1 Mscf natural gas). The Jordan Oxygen-Blown Blast Furnace process is described and the savings in natural gas consumption in the process are indicated. (MCW)

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 31636, 31775, 31776, 31777, 31783, 32159, 32189, 32191

32196 (ORNL-tr—4756) District heating from Forsmark. (Oak Ridge National Lab., TN (USA)). [nd]. Translation of report from Storstockholms Energiab (STOSEB) and Water Authority, 1980-11-28. 64p. NTIS, PC A04/MF A01. Order Number DE81026874.

The study compares the possibility of basing the heat supply for the Stockholm region (and Uppsala) on heat from Forsmark (Forsmark alternative) with an alternative in which the heat supply would be based on the further construction of fossil-fuel plants (fossil-fuel alternative) in the Stockholm region. Two alternatives for altering Forsmark 3 for district heating are examined - direct bleeding and installation of a new backpressure turbine. The systems and design and operation of the district heating pipelines for each alternative are described. A general description of the required permits and resolutions, the timetable assumed for the Forsmark alternative, and certain safety questions is presented. Summary information is presented on costs and financing, estimated power, heat balances, and fuel consumption for each alternative. Environmental impacts of the district-heating alternatives are investigated. Both alternatives are considered technically feasible. Schematics of the systems are included. (MCW)

32197 (DOE/CE/10328—1) California cogeneration and small-power-production pricing study. (California Public Utilities Commission, San Francisco (USA)). Apr 1981. Contract FG01-80CS10328. 55p. NTIS, PC A04/MF A01. Order Number DE81028116.

The California Public Utilities Commission conducted a study to assist public utilities commisions nationwide in implementing policy for cogeneration and small power production technologies. The effort consisted of studies and hearings related to avoided-cost based pricing, identification and removal of regulatory barriers, and workshops to assist potential cogenerators. The primary focus of this study is cogeneration, however, the analysis of pricing guidelines also address as the applicability for small power production facilities as well as their unique characteristics. The study is divided into four segments, or tasks each of which focuses on separate areas for review and/or analysis. This report represents Task I, and consists of a case history documentation of authorized prices and contract terms for cogenerators and small power producers in California resulting from Commission action in 1979. Subjected covered are: marginal-cost offers versus shared benefits (theory); marginal energy and capacity costs; requirements for capacity payments; simultaneous purchase and sale; new qualifying facilities versus old qualifying facilities; rates for standby service, maintenance, and interruptible power; wheeling; auxiliary power sources; utility ownership and joint benefits; rate of return reward/penalties; and interconnection costs.

32198 (DOE/CS/20170—1) Model request for proposals: the Brooklyn Navy Yard resource recovery facility. (New York City Dept. of Sanitation (USA); New York City Corporation Counsel (USA)). Jul 1981. Contract FG01-79CS20170. 150p. NTIS, PC A07/MF A01. Order Number DE81029816.

An invitation to make proposals to the City of New York for a resource recovery facility to be located at the Brooklyn Navy Yard is issued. The information provided in this request for proposals (RFP) is designed to guide the Proposer in the preparation and submission of a proposal. Section 2 provides information on the City's solid waste management system, and its approach to resource recovery, as well as general background information necessary to respond to this RFP. Each proposal shall contain a statement of work, broadly outlined in Section 3, for the design, construction, start-up, acceptance testing, operation, and maintenance of a resource recovery facility that will satisfy the technical specifications presented in Section 4. The statement of work will include provisions for working with the City and providing information for the financing of the facility and negotiating a final Steam Purchase Contract with Con Ed. It will also include tasks associated with the marketing of recovered materials and managing the project. Deliverables (outputs) from the project are also outlined in Section 3. Detailed instructions for preparing a proposal are presented in Section 5. The consideration of proposals submitted in response to this RFP, and any selection of a proposal, shall be based on, among other factors, the technical soundness of the overall design, the bid Construction Price, the bid Annual Operation Fee, the bid Consumer Price Index Adjustment Factor, the bid Revenue Sharing Factor, the proposed construction schedule, the performance guarantees offered, and the qualifications and financial strength of the Proposer. Details on the proposal evaluation process are provided in Section 6.

32199 (DOE/CS/20240—1) Energy recovery from municipal waste development program for Idaho Falls, Idaho Final report. (Energy, Inc., Idaho Falls, ID (USA)). Jul 1981. Contract AC01-79CS20240. 155p. NTIS, PC A08/MF A01. Order Number DE81029999.

Phase I of a development program to design, build, and operate a demonstration facility to show that fluidized-bed technology is a viable means to recover resources from municipal wastes in Idaho Falls is described. The following tasks are described in detail: (a) evaluation of the energy market of Idaho Falls to identify potential customers for recovered energy and to determine what form of energy would be economically viable, (b) evaluation of the MSW of Idaho Falls, determining its approximate composition, heating value, production rates, and seasonal variations; (c) development of a resource recovery facility concept that will be economically attractive to the city and technically feasible; and (d) evaluation of such topics as zoning, legal limitations, and environmental aspects of the facility to determine its compatibility with the city of Idaho Falls. Information in the appendices includes: population projections; responses to energy consumption survey; city weighing data (municipal solid waste); public works progress reports; steam revenue calculations; and legal memorandum on municipal solid wastes. (MCW)

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

32200 (AD-A—089279) Maritime patrol aircraft engine study, General Electric Derivative Engines. Volume III. Appendix B: performance data, TF 34/T7 study AL turboprop. Final report October 1978-April 1979. Hirschkron, R.; Davis, R.H.; Warren, R.E. (General Electric Co., Lynn, MA (USA). Aircraft Engine Group). 30 Apr 1979. Contract N62269-78-C-0414. 81p. NTIS, PC A05/MF A01.

This study developed data on General Electric common core derivative engines for use in Maritime Patrol Aircraft (MPA) concept formulation studies. The study included the screening of potential General Electric turbofan and turboprop/turboshaft engines and the preparation of technical and planning information on three of the most promising engine candidates. Screening of General Electric derivative candidates was performed utilizing an analytical MPA model using synthesized mission profiles to rank the candidates in terms of fuel consumption, weight, cost and complexity. The three turboprop engines selected for further study were as follows: TF34 growth derivative version with boost and new LPT (TF34/T7 Study A1), F404 derivative with booster stages and new LPT (F404/T1 Study A1), and GE27 scaled and boosted study engine (GE27/T3 Study A1). Volume I summarizes the screening analysis and contains technical, planning, installation, cost and development data for the three selected turboprop engines. Volumes II, III and IV of this report contain the detailed performance data estimates for the GE27/T3 Study A1, TF34/T7 Study A1 and F404/T1 Study A1 turboprop engines, respectively.

32201 (AD-A—089298) Generator Exhaust Signature Suppression (GESS) system mounting adapters for the 15 kW and 30 kW DOD diesel engine generators. Final report. Wallace, R.E. (Varo, Inc., Garland, TX (USA). Texas Div.). Jun 1980. Contract DAAK70-79-C-0207. 44p. NTIS, PC A03/MF A01.

This development was for 2 adapters to allow mounting of the Generator Exhaust Signature Suppression System (GESS) duct to 15 kW and 30 kW diesel driven generators. Adapters are mountable on these generators without any modification to the generators except removal of 13 bolts and the weather cap. Use of both adapters mounts the GESS duct in a horizontal attitude so that no hot parts of the duct are seen above a horizontal plane through the duct.

32202 (AD-A—089336) Maritime patrol aircraft engine study, General Electric Derivative Engines. Volume II. Appendix A: performance data, Ge27/T3 study A1 turboprop. Final report, October 1978-April 1979. Hirschkron, R.; Davis, R.H.; Warren, R.E. (General Electric Co., Lynn, MA (USA). Aircraft Engine Group). 30 Apr 1979. Contract N62269-78-C-0414. 81p. NTIS, PC A05/MF A01.

This study developed data on General Electric common core derivative engines for use in Maritime Patrol Aircraft (MPA) concept formulation studies. The study included the screening of potential General Electric turbofan and turboprop/turboshaft engines and the preparation of technical and planning information on three of the most promising engine candidates. Screening of General Electric derivative candidates was performed utilizing an analytical MPA model using synthesized mission profiles to rank the candidates in terms of fuel consumption, weight, cost and complexity. The three turboprop engines selected for further study were as follows: TF34 growth derivative version with boost and new LPT (TF34/T7 Study A1), F404 derivative with booster stages and new LPT (F404/T1 Study A1), and GE27 scaled and boosted study engine (GE27/T3 Study A1). Volume I summarizes the screening analysis and contains technical, planning, installation, cost and development data for the three selected turboprop engines. Volumes II, III and IV of this report contain the detailed performance data estimates for the GE27/T3 Study A1, TF34/T7 Study A1 and F404/T1 Study A1 turboprop engines, respectively.

32203 (AD-A—089337) Maritime patrol aircraft engine study, General Electric Derivative Engines. Volume IV. Apendix C: performance data, F404/T1 study A1 turboprop. Final report, October 1978-April 1979. Hirschkron, R.; Davis, R.H.; Warren, R.E. (General Electric Co., Lynn, MA (USA). Aircraft Engine Group). 30 Apr 1979. Contract N62269-78-C-0414. 81p. NTIS, PC A05/MF A01.

This study developed data on General Electric common core derivative engines for use in Maritime Patrol Aircraft (MPA) concept formulation studies. The study included the screening of potential General Electric turbofan and turboprop/turboshaft engines and the preparation of technical and planning information on three of the most promising engine candidates. Screening of General Electric derivative candidates was performed utilizing an analytical MPA model using synthesized mission profiles to rank the candidates in terms of fuel consumption, weight, cost and complexity. The three turboprop engines selected for further study were as follows: TF34 growth derivative version with boost and new LPT (TF34/T7 Study A1), F404 derivative with booster stages and new LPT (F404/T1 Study A1), and GE27 scaled and boosted study engine (GE27/T3 Study A1). Volume I summarizes the screening analysis and contains technical, planning, installation, cost and development data for the three selected turboprop engines. Volumes II, III and IV of this report contain the detailed performance data estimates for the GE27/T3 Study A1, TF34/T7 Study A1 and F404/T1 Study A1 turboprop engines, respectively.

32204 (AD-A—089451) Compound cycle turbofan engine (CCTE). Task IX. Carbon-slurry fuel combustion evaluation program. Final report June-September 1979. Bruce, T.W.; Mongia, H. (AiResearch Mfg. Co., Phoenix, AZ (USA)). Mar 1980. Contract F33657-77-C-0391. 101p. NTIS, PC A06/MF A01.

The carbon-slurry fuel evaluation program demonstrated the feasibility of running a currently available carbon-slurry fuel in a combustion rig and a turbine engine. This program also established the preliminary design criteria for operating on carbon-slurry fuels. Subcontracts work was performed by Pennsylvania State for fuel droplet measurements and by Suntech, Inc. for fuel development and manufacture.

32205 (ANL/CNSV-TM—74) Heavy-duty engines analysis, Study 2: analysis of emission regulations and test procedures for the gas turbine engine. Duleep, K.G. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-38. 117p. NTIS, PC A06/MF A01. Order Number DE81029990.

There is considerable interest in heavy-duty gas turbines (HDGT) suitable for use in trucks and buses because of their poten-

tial for reduced maintenance, improved fuel economy, better overall reliability, and cleaner exhaust emissions relative to existing (gasoline and diesel) heavy-duty engines. This analysis focuses on the application of current and expected emissions measurement techniques to heavy-duty gas turbines. The purposes of this report are to: identify emission requirements for heavy-duty engines applicable during and after completion of the DOE demonstration program, i.e. 1985; provide an understanding of current steady-state test procedures and applicability to the HDGT; describe the development and methodology of the test procedures and sampling techniques to measuring emissions from the HDGT; and assess the limitations and problems of current sampling techniques for regulated pollutants and identify promising methods of sampling that are applicable to the HDGT. This information should serve as a comprehensive guide to emissions testing requirements and test procedures for the HDGT.

32206 **(CONF-8006185—1) Survey of proposed methods of burning alcohol in diesel engines.** Foster, D.E. (Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering). 1980. Contract AC02-79CS50025. 10p. NTIS, PC A02/MF A01. Order Number DE81025834.

From Canadian national power alcohol conference; Manitoba, Canada (20 Jun 1980).

Different methods of burning alcohol in diesel engines are discussed. The primary difficulty in usng alcohol as a diesel fuel is initiation of the flame. The methods are categorized by the ignition technique used; spark or hot surface, pilot injection which includes twin injection and fumigation, cetane improvement and diesel/alcohol mixtures. Each method is analyzed on the basis of the maximum amount of alcohol that can be substituted for diesel fuel and the likelihood for retrofitting on current engines. It is concluded that emulsification and fumigation are currently the two most feasible methods for adapting diesel engines to burn alcohol.

32207 **(DOE/CS/50021—1) Influence of fuel variables on the operation of automotive open and pre-chamber diesel and spark ignited stratified charge engines: a literature study covering petroleum and syncrude derived fuels.** Needham, J.R. (Ricardo and Co. Engineers (1927) Ltd., Shoreham-by-Sea (UK)). Sep 1980. Contract AC01-80CS50021. 286p. NTIS, PC A13/MF A01. Order Number DE81029996.

A literature study has been carried out to ascertain the influence of fuels and fuel variables on the operation of automotive diesel and spark ignited stratified charge engines with a view to understanding the impact of future fuels derived from Syncrude. The findings from the search are presented and discussed in detail, conclusions reached and recommendations made.

32208 **(DOE/NASA/9696—1) Thermal fatigue performance of integrally cast automotive turbine wheels.** Humphreys, V.E.; Hofer, K.E. (IIT Research Inst., Chicago, IL (USA)). Jun 1980. Contract AI01-77CS51040. 84p. (NASA-CR—165227). NTIS, PC A05/MF A01. Order Number DE81029997.

Fluidized bed thermal fatigue testing was conducted on 16 integrally cast automotive turbine wheels for 1000 to 10,000 (600 sec total) thermal cycles at 935°/50°C. The 16 wheels consisted of 14 IN-792 + 1% Hf and 2 gatorized AF2-1DA wheels; 6 of the IN-792 + Hf wheels contained crack arrest pockets inside the blade root flange. Temperature transients during thermal cycling were measured in three calibration tests using either 18 or 30 thermocouples per wheel. Thermal cracking based on crack length versus accumulated cycles was greatest for unpocketed wheels with pocketed wheels developing cracks in 8 to 13 cycles compared to 75 to 250 cycles for unpocketed wheels. However, pocketed wheels survived up to 10,000 cycles with crack lengths less than 20 mm, whereas two unpocketed wheels developed 45 mm long cracks in 1000 to 2000 cycles.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 32179

32209 **(DOE/NASA/0032—12) Automotive Stirling reference engine design report.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Mechanical Technology, Inc., Latham, NY (USA). Stirling Engine Systems Div.). Jun 1981. Contract AI01-77CS51040. 133p. (NASA/CR—165381). NTIS, PC A07/MF A01. Order Number DE81029911.

The Reference Stirling Engine System, which was to provide the best possible fuel economy while meeting or exceeding all other program objectives is described. It was designed to meet the requirements of a Reference Vehicle, which is a 1984 GM Pontiac Phoenix (X-body). This design utilizes all new technology that can reasonably be expected to be developed by 1984 and that is judged to provide significant improvement, relative to development risk and cost.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 32090

32210 **(DOE/NASA/0081—2) Advanced electric propulsion system concept for electric vehicles. Addendum 1. Voltage considerations.** Raynard, A.E.; Forbes, F.E. (National Aeronautics and Space Administration, Washington, DC (USA); AiResearch Mfg. Co., Torrance, CA (USA)). Aug 1980. Contract AI01-77CS51044. 76p. (NASA/CR—165243). NTIS, PC A05/MF A01. Order Number DE81030193.

Seventeen electric vehicle propulsion systems were originally studied to select two designs that best met cost and performance goals. Both systems have now been examined to assess the effect of battery pack voltage on system performance and cost. A voltage range of 54 to 540 V was considered for a typical battery pack capacity of 24 kW-hr. The highest battery specific energy (W-hr/kg) and the lowest cost ($/kW-hr) were obtained at the minimum voltage level. The flywheel system traction motor is a dc, mechanically commutated machine with shunt field control, and due to the flywheel the traction motor and the battery are not subject to extreme peaks of power demand. Design changes in the battery pack voltage simply result in compensating changes in the motor configuration. The basic system uses a permanent-magnet motor with electronic commutation supplied by an ac power control unit. In this system the traction motor and power control unit must handle the peak power needed for acceleration. The traction motor can be designed to operate at specific battery voltages within a broad range, with little effect on motor efficiency, weight, or cost. The power control unit characteristics are effected by battery voltage, and the lowest voltages give the lowest efficiency, highest weight, and highest cost. In both systems, battery costs were the major factor in system voltage selection, and a battery pack with the minimum voltage of 54 V produced the lowest life-cycle cost. The minimum life-cycle cost for the basic system with lead-acid batteries was $0.057/km and for the flywheel system was $0.037/km.

32211 **(DOE/NASA/0123—1) Straight and chopped dc performance data for a General Electric 5BT 2366C10 motor and an EV-1 controller. Final report.** Edie, P.C. (National Aeronautics and Space Administration, Washington, DC (USA); Eaton Corp., Southfield, MI (USA). Engineering and Research Center). Jan 1981. Contract AT01-77CS51044. 51p. (NASA-CR—165322). NTIS, PC A04/MF A01. Order Number DE81028111.

This report is intended to supply the electric vehicle manufacturer with performance data on the General Electric 5BT 2366C10 series wound dc motor and EV-1 chopper controller. Data are provided for both straight and chopped dc input to the motor, at 2 motor temperature levels. Testing was done at 6 voltage increments to the motor, and 2 voltage increments to the controller. Data results are presented in both tabular and graphical forms. Tabular information includes motor voltage and current input data, motor speed and torque output data, power data and temperature data. Graphical information includes torque-speed, motor power output-speed, torque-current, and efficiency-speed plots under the various operating conditions. The data resulting

from this testing shows the speed-torque plots to have the most variance with operating temperature. The maximum motor efficiency is between 86% and 87%, regardless of temperature or mode of operation. When the chopper is utilized, maximum motor efficiency occurs when the chopper duty cycle approaches 100%. At low duty cycles the motor efficiency may be considerably less than the efficiency for straight dc. Chopper efficiency may be assummed to be 95% under all operating conditions. For equal speeds at a given voltage level, the motor operated in the chopped mode develops slightly more torque than it does in the straight dc mode. System block diagrams are included, along with test setup and procedure information.

32212 **(DOE/NASA/0123—2) Straight and chopped DC performance data for a Prestolit MTC-4001 motor and a General Electric EV-1 controller.** Edie, P.C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Eaton Corp., Southfield, MI (USA). Engineering and Research Center). Apr 1981. Contract AI01-77CS51044. 49p. (NASA-CR—165382). NTIS, PC A03/MF A01. Order Number DE81028183.

This report is intended to supply the electric vehicle manufacturer with performance data on the Prestolite MTC-4001 series wound DC motor and General Electric EV-1 Chopper Controller. Data is provided for both straight and chopped DC input to the motor, at 2 motor temperature levels. Testing was done at 6 voltage increments to the motor, and 2 voltage increments to the controller. Data results are presented in both tabular and graphical forms. Tabular information includes motor voltage and current input data, motor speed and torque output data, power data and temperature data. Graphical information includes torque-speed, motor power output-speed, torque-current, and efficiency-speed plots under the various operating conditions. The data resulting from this testing shows the speed-torque plots to have the most variance with operating temperature. The maximum motor efficiency is between 76 and 82%, regardless of temperature or mode of operation. When the chopper is utilized, maximum motor efficiency occurs when the chopper duty cycle approaches 100%. At low duty cycles the motor efficiency may be considerably less than the efficiency for straight DC. Chopper efficiency may be assumed to be 95% under all operating conditions. For equal speeds at a given voltage level, the motor operated in the chopped mode develops slightly more torque than it does in the straight DC mode. System block diagrams are included, along with test setup and procedure information.

32213 **(DOE/NASA/0189—81/1) Testing of the permanent magnet material Mn-Al-C for potential use in propulsion motors for electric vehicles.** Abdelnour, Z.; Mildrum, H.; Strnat, K. (National Aeronautics and Space Administration, Washington, DC (USA); Dayton Univ., OH (USA)). Mar 1981. Contract AI01-77CS51044. 69p. (NASA-CR—165291). NTIS, PC A04/MF A01. Order Number DE81028524.

The development of Mn-Al-C permanent magnets is briefly reviewed. The general properties of the material are discussed and put into perspective relative to alnicos and ferrites. The traction-motor designer's demands of a permanent magnet for potential use in electric vehicle drives are reviewed. From this, a list of the needed specific information is extracted. A plan for experimental work is made which would generate this information, or verify data supplied by the producer. These planned tests and measurements were executed in our laboratory. The results of these measurements are presented in the form of tables and graphs. The data are discussed and interpreted. The tests determined magnetic design data and some mechanical strength properties. Easy-axis hysteresis and demagnetization curves, recoil loops and other minor-loop fields were measured over a temperature range from -50°C to +150°C. Hysteresis loops were also measured for three orthogonal directions (the one easy and 2 hard axes of magnetization). The data as measured are presented in considerable detail. In this form it would be of use in motor design calculations. Simpler summary graphs and tables that allow one to get a quick picture of the behavior of Mn-Al-C magnets in general are also included. If the use of this material in motors is seriously considered, more information about the temperature dependence of the flux at different operating points, irreversible losses on heating, and the long-term flux stability at elevated temperatures should be generated.

32214 **(UCRL—85526) Future of electricity for automobiles: advanced electric vehicle concepts.** O'Connell, L.G. (Lawrence Livermore National Lab., CA (USA)). 29 Jul 1981. Contract W-7405-ENG-48. 14p. (CONF-811010—3). NTIS, PC A02/MF A01. Order Number DE81028235.

From 6. electric vehicle council symposium; Baltimore, MD, USA (21 Oct 1981).

A large and growing effort involving both the federal government and industry is underway to develop and commercialize highway vehicles that utilize electricity. The electricity they use can be generated from nonpetroleum fuels. The Department of Energy, through its Electric and Hybrid Vehicle Program, is the principal federal agency involved in this work. The goal is to replace petroleum-consuming vehicles now operating on our roadway system with ones that utilize electricity as a primary fuel. However, commercially available electric vehicles (EV) do not compete on a performance (acceleration and range) or cost basis with comparably sized internal combustion engine vehicles. Although today's electric vehicles will certainly find some commerical acceptance, we need an automobile with general-purpose capability if we are to appeal to the larger market. I have labeled such an automobile the Advanced Electric Vehicle. Thus by definition, the Advanced Electric Vehicle is an automobile capable of filling the general-purpose role of today's gasoline-powered car and uses electricity as its principle fuel. It is either an EV, hybrid vehicle (HV), or some other nonpetroleum electricity-based system, such as a fuel cell vehicle (FCV). Is this Advanced Electric Vehicle in our future. To determine this we need to have an understanding of what may be possible. Performance criteria for such a vehicle are presented and, in addition, various concepts that may be suitable for this vehicle are identified--their likely capabilities are discussed as well as the difficulties that must be overcome prior to commercialization in each case.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 32214

3305 Flywheel Propulsion

REFER ALSO TO CITATION(S) 32081

3306 Vehicle Design Factors

32215 **(DOE/CS/51095—T3) Study on reduction of accessory horsepower requirements. Eleventh quarterly progress report.** (Garrett Corp., Phoenix, AZ (USA). Airesearch Mfg. Div.). 30 Apr 1977. Contract AC03-76CS51095. 76p. NTIS, PC A05/MF A01.

Progress in a program for optimizing automotive accessory systems to achieve greater vehicle fuel economy and improved accessory performance is reported. The major technical accomplishments during this reporting period were: all candidate advanced air conditioning concepts were evaluated; advanced air conditioning and hybrid accessory drive component trade-studies were completed; improved alternator, water pump and power steering system concepts were evaluated; the vehicle integrated accessory systems trade-study was completed; and the technical summary report for the Phase V Automotive Accessory Systems Optimization Program was initiated. (LCL)

32216 **(DOE/CS/51095—T4) Final technical study on reduction of automotive accessory power requirements. Final report, June 1974-June 1978.** (AiResearch Mfg. Co., Phoenix, AZ (USA)). 20 Oct 1978. Contract AC03-76CS51095. 689p. NTIS, PC A99/MF A01. Order Number DE81026116.

The objective of this program was to define, evaluate, and develop automotive accessory systems to minimize engine power consumption and significantly improve fuel economy. Standard accessory equipment includes air conditioning, power steering alternator, engine cooling fan, water pump, and emissions air pump. The

program studies included conceptual, preliminary, and detail design of accessory systems for internal combustion engine vehicles plus component fabrication and performance testing. Accessory drives, such as variable speed and hydrid drives, for standard and advanced air conditioning systems were evaluated. Finally, accessories for advanced vehicular engines, e.g., gas turbines and Stirling engines, were investigated. As a result of the Accessory System Optimization Program, it was concluded that the effect of accessory loads on the overall fuel economy of present day internal combustion engine automobiles can be decreased by as much as 50% by applying technology well within present manufacturing capability. Further improvements in fuel economy could also be achieved through development of hybrid drive concepts if the market would bear the attendant cost increases. The automotive Stirling and gas turbine advanced engine study produced specific accessory design concepts to limit power requirements and maximize overall fuel economy. Integrated, variable speed, accessory systems for the Stirling application and waste heat conservation for the gas turbine were recommended for development. A dual air conditioning/ waste heat regeneration concept was proposed for gas turbine application and a helical screw compressor-expander was designed. The advanced engine accessory study strongly recommends concurrent development of engine and accessories.

3307 Emission Control

REFER ALSO TO CITATION(S) 32201, 32205

32217 **(PB—81-122004) The effects of emission control system malfunctions or maladjustments on exhaust emissions. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Oct 1976. 15p. NTIS, PC A02/MF A01.

The Environmental Protection Agency is currently undertaking programs that measure the exhaust emissions of in-use vehicles. One of these programs, the Emission Factors Program (EFP), has generated data indicating that a high percentage of in-use 1975 automobiles have exhaust emissions exceeding the Federal emission standards for 1975-1976 light-duty vehicles. Typical failing vehicles have very high CO emissions. High CO emissions may be indicative of improper adjustment of either the idle mixture or the choke. Since idle mixture and choke adjustments are easily accessible and adjusted on most cars, it seems probable that the maladjustment of these two items may be responsible for some of the high emission levels measured in the EFP. In order to further investigate these possibilities, a test program was conducted by the EPA to quantify the effects of various engine maladjustments on exhaust emissions. This test program would help identify maladjustments resulting in the types of failures encountered in the EFP.

32218 **(PB—81-123028) Results of sulfate tests on prototype vehicles. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Sep 1976. 46p. NTIS, PC A03/MF A01.

In January, 1976, the Office of Mobile Source Air Pollution Control (OMSAPC) of the EPA distributed a report on the results of the sulfuric acid baseline program. The report contained results of tests on 56 non-catalyst and catalyst equipped vehicles designed to meet various light duty vehicle emission standards. Since that time, EPA-OMSAPC has continued testing various prototype vehicles with advanced emission control systems. This report discusses the results of OMSAPC testing since completion of the last baseline program report. Fourteen vehicles were tested for gaseous and sulfate emissions during this period. The objective was to further characterize sulfuric acid emissions from vehicles with technologically advanced emission control systems.

32219 **(PB—81-123499) Testing support for evaluation of inspection/maintenance issues (Test Group Nos. 6 and 8). Technical report.** Ashby, H.A. (Hamilton Test Systems, Inc., Phoenix, AZ (USA)). 1979. Contract EPA-68-03-2829. 47p. NTIS, PC A03/MF A01.

The intention of test group no. 6 was to evaluate the effect on exhaust emissions of disabling the heated air intake system. Ten vehicles were selected from the loaner fleet and were tested before and after disablement of the heated air intake system. No discernible difference was found between the before and after results. This result was attributed to the short period of time the heated air damper remained in the open position for the 'before disablement' test. Since all vehicles were cold soaked at a nominal temperature of 77 F, the temperature rapidly reached an operating temperature to close the damper. The intent of test group no. 8 was to provide test data to be used to evaluate the ability of various catalyst diagnostic tests to diagnose poisoned catalysts. The poisoning of the catalyst was accomplished by accumulating mileage using tankfuls of leaded fuel. After repeated tankfuls of leaded fuel were consumed, mileage was accumulated using tankfuls of unleaded fuel to provide data for evaluation of the rejuvenation process of the catalytic converter.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 31622, 32204, 32206

36 MATERIALS

32220 **(DOE/ER—0106) Materials sciences programs. Fiscal year 1981.** (Department of Energy, Washington, DC (USA). Office of Energy Research). Sep 1981. 180p. NTIS, PC A09/MF A01. Order Number DE81030306.

The purpose of this report is to provide a convenient compilation and index of the DOE Materials Sciences Division programs. This compilation is intended for use by administrators, managers, and scientists to help coordinate research and as an aid in selecting new programs. The report is divided into Sections A and B, listing all the projects, Section C, a summary of funding levels, and Section D, an index (the investigator index is in two parts - laboratory and contract research).

32221 **(DOE/ER/02422—29) Materials and mechanics of rate effects in brittle fracture. Final report.** Burns, S.J. (Rochester Univ., NY (USA). Dept. of Mechanical Engineering). Jul 1981. Contract AS02-76ER02422. 16p. NTIS, PC A02/MF A01. Order Number DE81028489.

This document summarizes results of studies on: dynamic analysis of rapidly wedged double cantilevered beam specimens; experimental measurements of stress intensity factors for a propagating brittle crack in steel at selected temperatures; elastic, nonlinear fracture analysis in a thermodynamic formalism using energy balances; mechanical fracture stability for either constant load or constant displacement specimens; measuring J/sub IC/ by recording the load versus the loadpoint displacement for two specimens that have a finite difference in crack area; creep cracking and determination of the activation enthalpy for the rate controlling process in steady-state crack propagation - crack velocity measurements over nine orders of magnitude; experimental determination of the athermal component of the crack driving force establishing its temperature independence; and elastic solutions for a single dislocation and arrays of dislocations at a sharp crack tip, proving crack tip dislocation shielding concept.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 31529, 31547, 31650, 31658, 31722, 31727, 31823, 31927, 31934, 31964, 31965, 31966, 31967, 31968, 31974, 31975, 31976, 31977, 31980, 31981, 32012, 32012, 32037, 32040, 32689, 32733, 32745, 32757

32222 **(BDX—613-2477) CVD tungsten - rhenium alloy corrosion behavior.** Engelhaupt, D.E. (Bendix Corp., Kansas City, MO (USA)). Aug 1981. Contract AC04-76DP00613. 41p. NTIS, PC A03/MF A01.

The chemical and electrochemical corrosion behavior of chemical vapor deposited tungsten-rhenium alloy has been studied using nitric and sulfuric acid mixtures to remove the deposition substrate. The alloy corrosion rates as a function of acid composition, aeration, and temperature were established. Computer-aided analysis of polarization data showed that the tungsten-rhenium etched faster in dilute nitric acid solutions. The logarithmic etch rate was proportional to the reciprocal of the etchant temperature. Selective etching of the surface was more severe for alloys with an excess of

eighteen weight percent rhenium. Protective coatings were studied and their respective merits are considered.

32223 **(BNL—29589) Electrochemical aspects of stress-corrosion cracking in α-brass.** Burstein, G.T.; Newman, R.C. (Cambridge Univ. (UK). Dept. of Metallurgy and Materials Science). 1981. Contract AC02-76CH00016. 11p. (CONF-811013—1). NTIS, PC A02/MF A01. Order Number DE81022078.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

This paper considers a number of aspects of the stress-corrosion cracking of brass from the point of view of the localized electrochemical processes occurring at the tip of a propagating crack. The principal system examined is the intergranular SCC of 70-30 brass in near-neutral ammoniacal solutions, for which a detailed mechanism is developed. In addition, the effects of nitrite ions in promoting SCC of both brass and copper are considered.

32224 (CONF-810316—, pp 35-38) **Amorphous metallizations for high-temperature semiconductor device applications.** Wiley, J.D. (Univ. of Wisconsin, Madison); Perepezko, J.H.; Nordman, J.E.; Kang-Jin, G. 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

In this paper the initial results are presented of work on a new class of semiconductor metallizations which appear to hold great promise as primary metallizations and diffusion barriers for high-temperature device applications. These metallizations consist of sputter-deposited films of high-T/sub g/amorphous-metal alloys which (primarily because of the absence of grain boundaries) exhibit exceptionally good corrosion-resistance and low diffusion coefficients. Amorphous films of the alloys Ni-Nb, Ni-Mo, W-Si, and Mo-Si have been deposited on Si, GaAs, GaP, and various insulating substrates. The films adhere extremely well to the substrates and remain amorphous during thermal cycling to at least 500°C. Rutherford Backscattering (RBS) and Auger Electron Spectroscopy (AES) measurements indicate atomic diffusivities in the 10^{-19} cm^2/S range at 450°C.

32225 **(CONF-810741—1) Mechanicl relaxation response of 2 1/4 Cr-1 Mo steel.** Swindeman, R.W. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE81027301.

From 28. sagamore army materials conference; Lake Placid, NY, USA (13 Jul 1981).

The mechanical relaxation of 2 1/4 Cr-1 Mo steel was examined in the temperature range 450 to 566°C for times to 100 h. Data from four heats were included. The relaxation strength was found to vary with heat treatment by a factor of three from the weakest to the strongest. The extent of recovery and tempering that occurred during relaxation was displayed by means of isochronous stress vs strain curves constructed from multiple loading tests. Recovery of the yield strength during relaxation was observed at temperatures as low as 538°C. Relaxation response after cyclic strain was examined and found to be identical to response after monotonic strain providing that the starting stress was at the tip of the hysteresis loop. At other positions within the hysteresis loop the relaxation responses was influenced by the direction of the prior inelastic strain. The salient features of the relaxation response were consistent with expectations based on a material deformation model that included parameters to accommodate kinematic and isotropis hardening. 17 figures.

32226 **(CONF-810801—55) Chromium-molybdenum steels for fusion-reactor applications.** Klueh, R.L. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE81029141.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

Because ferritic steels have been found to have excellent resistance to swelling when irradiated in a fast-breeder reactor, Cr-Mo steels have recently become of interest for nuclear applications, both as cladding and duct material for fast-breeder reactors and as a first-wall and blanket structural material for fusion reactors. In this paper we will assess the Cr-Mo steels for fusion reactor applications. Possible approaches on how Cr-Mo steels may be further developed for this application will be proposed.

32227 **(CONF-810809—15) Magnetic properties of Ni in MgO; Ni^{+2} ions and magnetically ordered precipitates.** Thompson, J.R.; Sekula, S.T.; Chen, Y. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029142.

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 Aug 1981).

Magnetic properties of Ni in MgO have been investigated, using a vibrating sample magnetometer. The samples were studied in two forms, as prepared with Ni ions in solution and chemically reduced with the Ni in microscopic precipitates. The initial materials exhibited paramagnetic behavior, having a Curie Law susceptibility with an effective moment per ion p = 3.08 μ/sub B/. (g = 2.18, with S = 1 for Ni^{+2} ions). Upon reduction, magnetic precipitates were formed, characterized by hysteresis and remanent moments. The observed low-temperature saturated moment per Ni of gS = 0.32 μ/sub B/, observed for several samples, as well as the temperature dependence of the saturation magnetization, indicates that the magnetic bahavior of the precipitates is rather different from bulk Ni.

32228 **(CONF-810831—19) High-temperature fatigue behavior of unirradiated V-15Cr-5Ti tested in vacuum.** Liu, K.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028557.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Limited results of in-vacuum fatigue tests are presented for unirradiated V-15Cr-5Ti tested at room temperature, 550, and 650°C, respectively. The test data were analyzed using a power law equation to correlate the total strain range and cycles to failure. Comparison with data for 20% cold-worked Type 316 stainless steel tested at 550°C shows that on the basis of strain range the vanadium alloy is about the same as the stainless steel below 10,000 cycles to failure but becomes superior above the point. The general data trend further suggests that endurance limits may exist at strain ranges of approximately 0.7 and 0.6% at 550 and 650°C, respectively.

32229 **(CONF-810831—25) Damage structure in Nimonic PE16 alloy ion bombarded to high doses and gas levels.** Farrell, K.; Packan, N.H. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE81028562.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The Nimonic PE16 alloy in solution-treated-and-aged condition was bombarded simultaneously with nickel ions and α and deuteron beams at 625°C to doses of 80 to 313 dpa at He/dpa = 10 and D/dpa = 25. Microstructural changes consisted of the introduction of dislocations and of cavities, and the redistribuion of γ′ precipitates to these defects. Cavitational swelling remained below 1%. Cavities were represented by several distinct size classes, the smaller ones believed to be gas bubbles, and some larger ones associated with preferred growth of precipitate. Formation of bubbles at grain boundaries, and large cavities at incoherent twins intensified the possibility of mechanical separation of interfaces under high-gas irradiation conditions.

32230 **(CONF-810831—26) Depth distribution of displacement damage in α-iron under triple beam ion irradiation.** Horton, L.L.; Bentley, J.; Jesser, W.A. (Oak Ridge National Lab., TN (USA); Virginia Univ., Charlottesville (USA). Dept. of Materials Science). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC APC A02/MF A01. Order Number DE81028563.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The depth dependence of the defect structures was determined for iron irradiated at 850°K with 4 MeV Fe^{2+} and energetic helium and deuteron ions to 10 dpa and fusion levels of helium and deuterium. From the damage profiles, a sectioning depth of 0.9 μm

was selected for studies of iron and bcc iron alloys, such as ferritic steels, utilizing similar irradiation parameters. A comparison of the experimental damage profile to the deposited energy and deposited ion profiles calculated by E-DEP-1 indicated a possible overestimate of the LSS stopping power of at least 22%.

32231 (CONF-810831—27) Corrosion of type 316 stainless steel in molten LiF-LiCl-LiBr. Tortorelli, P.F.; DeVan, J.H.; Keiser, J.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE81028633.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The properties of LiF-LiCl-LiBr salt make it attractive as a solvent for extracting tritium from a fusion reactor lithium blanket. Consequently, the corrosion of type 316 stainless steel by flowing (about 15 mm/s) LiF-LiCl-LiBr at a maximum temperature of 535°C was studied to determine whether compatibility with the structural material would be limiting in such a system. The corrosion rate was found to be low (<2 μm/year) except immediately after the addition of a small amount of lithium metal to the salt. The lithium addition increased the corrosion rate to $\sim$ 13.5 μm/year at 535°C (approximately that of type 316 stainless steel exposed to lithium flowing at a similar velocity). At the proposed operating temperature ($\leqq \sim$ 535°C), however, it appears that type 316 stainless steel has acceptable compatibility with the tritium-processing salt LiF-LiCl-LiBr for use with a lithium blanket.

32232 (CONF-810831—28) High-temperature fatigue life of type 316 stainless steel containing irradiation induced helium. Grossbeck, M.L.; Liu, K.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028879.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Specimens of 20%-cold-worked AISI type 316 stainless steel were irradiated in the High Flux Isotope Reactor (HFIR) at 550°C to a maximum damage level of 15 dpa and a transmutation produced helium level of 820 at. ppM. Fully reversed strain controlled fatigue tests were performed in a vacuum at 550°C. No significant effect of the irradiation on low-cycle fatigue life was observed; however, the strain range of the 10^7 cycle endurance limit decreased from 0.35 to 0.30%. The relation between total strain range and number of cycles to failure was found to be $\Delta\epsilon/\text{sub T/} = 0.02\text{N/sub f/}^{-0.12} + \text{N/sub f/}^{-0.6}$ for N/sub f/ $< 10^7$ cycles.

32233 (CONF-810831—29) Swelling, microstructural development and helium effects in type 316 stainless steel irradiated in HFIR and EBR-II. Maziasz, P.J.; Grossbeck, M.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028603.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

This work examines the swelling and microstructural development of a single heat of 20%-cold-worked type 316 stainless steel irradiated to produce displacement damage and a high, continuous helium generation rate, in the High Flux Isotope Reactor (HFIR). Similar irradiation of the same heat of steel in the Experimental Breeder Reactor (EBR)-II is used as a base line for comparing displacement damage accompanying a very low continuous helium generation rate. At temperatures above and below the void swelling regime ($\sim$ 350 to 625°C) swelling is greater in HFIR than in EBR-II. In the temprature range of 350 to 625°C, cavity formation, precipitation and dislocation recovery are both enhanced and accelerated in HFIR, often causing swelling at lower dose than in EBR-II. In HFIR, however, cavities appear to be bubbles rather than voids. They are about 10 times smaller and 20 to 50 times more numerous than voids in EBR-II. Thus, the swelling becomes greater in EBR-II than in HFIR for 20%-CW 316 in the void swelling temperature ranges as fluence increases. Such differences in swelling and microstructural behavior must be understood in order to anticipate the behavior of materials during fusion irradiation.

32234 (CONF-810831—30) Effects of pulsed dual-ion irradiation of microstructural development. Packan, N.H. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028631.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The effect of pulsed irradiation on the development of microstructure during Ni ion bombardment has been investigated in a simple austenitic alloy similar to type 316 stainless steel. Bombardment conditions were 10 dpa, 940 K, pulsing with equal on/off times of either 0.5 or 60 s, and the addition of 20 appM He/dpa to some specimens either by room temperature preimplantation or by dual-beam coimplantation. Particular care was taken to minimize thermal pulses from beam heating (to <2°C). The results show that pulsing has a subtle influence, and the effects on specific cavity parameters are complex. Pulsing produced a small increase in swelling in the helium-free case, but a slight decrease for helium-implanted specimens, and it seems to have counteracted the usual stimulative effects of helium on cavity nucleation.

32235 (CONF-810831—31) Influence of neutron irradiation at 55°C on the properties of austenitic stainless steels. Wiffen, F.W.; Maziasz, P.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE81028065.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Types 316 and 316 + 0.23 wt % Ti stainless steels and 16-8-2 weldment were irradiated in HFIR at 55°C to fluences up to 1.35 x 10^{26} neutrons/m^2 ($<$ 0.1 MeV), which produced up to 10.5 dpa and 520 at. ppM He. Examination showed no swelling, no cavities, no precipitates, but a high concentration of dislocations. Tensile tests showed large increases in the 35°C strength properties, with the weldments the weakest of the materials. The ductility of all materials was reduced by the irradiation, the uniform elongation to only 0.4% in the cold-worked material. Tests at temperatures above the irradiation temperature showed an approach to unirradiated properties as the temperature was increased from 200 to 600°C. Helium embrittlement at 700°C severely reduced elongation.

32236 (CONF-810831—32) Microstructure of triple-beam ion irradiated Fe and Fe-Cr alloys. Horton, L.L.; Bentley, J.; Jesser, W.A. (Oak Ridge National Lab., TN (USA); Virginia Univ., Charlottesville (USA). Dept. of Materials Science). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028347.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The development of defect structures in Fe-10% Cr, triple-beam (He^+, D_2^+ and 4 MeV Fe^{++}) ion irradiated to 10 dpa at temperatures from 725 to 950 K has been studied. Limited cavity formation was observed. Peak swelling of $\sim$ 0.02% occurred at irradiation temperatures of $\sim$ 850 K. Similar irradiations at this temperature led to $\sim$ 0.22% swelling in iron, while no cavities were observed in Fe-5% Cr. Calculations have shown that cavities formed at 875 K and above are more bubble-like than those at lower temperatures. Dislocation structures varied from interstitial dislocation loops with b = a$<$100$>$ at low temperatures to a coarse dislocation network at 850 K. Large dislocation loops had a convoluted shape which suggested that loop growth had occurred preferentially in $<$110$>$ directions. The results are discussed and related to current swelling suppression mechanisms for ferritic steels.

32237 (CONF-810831—33) Precipitation and cavity formation in austenitic stainless steels during irradiation. Lee, E.H.; Rowcliffe, A.F.; Mansur, L.K. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE81028062.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Microstructural evolution in austenitic stainless steels subjected to displacement damage at high temperature is strongly influenced by the interactions between helium atoms and second phase particles. Cavity nucleation occurs by the trapping of helium at partially coherent particle-matrix interfaces. The recent precipi-

tate point defect collector theory describes the more rapid growth of precipitate-attached cavities compared to matrix cavities where the precipitate-matrix interface collects point defects to augment the normal point deflect flux to the cavitry. Data are presented which support these ideas. It is shown that during nickel ion irradiation of a titanium-modified stainless steel at 675°C the rate of injection of helium has a strong effect on the total swelling and also on the nature and distribution of precipitate phases.

32238 (CONF-810831—36) Tensile properties and microstructure of helium-injected and reactor-irradiated V-20 Ti. Tanaka, M.P.; Bloom, E.E.; Horak, J.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE81029114.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Mechanical properties and microstructure of vanadium-20% titanium were examined following helium-injection and reactor irradiation. Helium was injected at ambient temperature to concentrations of 90 and 200 at. ppM; neutron irradiation was at 400, 575, 625, and 700°C to fluence of 3×10^{26} n/m^2, E > 0.1 MeV. Cavities representing negligible volume swelling were observed in all helium-injected specimens. Degradation of mechanical properties, especially loss of ductility due to helium, occurred at temperatures of 625 and 700°C. The levels of helium produced in the fusion spectrum can be expected to alter the response of vanadium alloys from that observed in fast reactor irradiations.

32239 (CONF-810835—7) Testing results of MF-Nb_3Sn composites made by a modified jellyroll method. Shen, S.S.; McDonald, W.K. (Oak Ridge National Lab., TN (USA); Wah Chang Albany Corp., Albany, OR (USA)). 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE81028632.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A new method to produce multifilamentary (MF) Nb_3Sn superconductor called modified jellyroll has been recently developed by Teledyne Wah Chang, Albany. The novel technique shows real promise to simplify the manufacture of MF superconducting wires. Unlike the conventional, internal bronze process which employs niobium in either rod or tube form, modified jellyroll (MJR) uses an expanded niobium foil in its billet assembly. Simply by rolling thin expanded niobium foil along with other metal sheets, as desired (e.g., copper, bronze, tantalum, etc.), into a jellyroll form, the resultant billet can then be extruded and processed as conventional wires. This paper presents results of systematic evaluation tests performed on such composites. The results are analyzed and discussed in terms of critical current density, diffusion time constant, ac losses (magnetization), and the effective filamentary diameter.

32240 (CONF-810835—10) Specific heat of NbTi from 0 to 7 T between 4.2 and 20 K. Elrod, S.A.; Miller, J.R.; Dresner, L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE81028083.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Specific heat measurements are reported for an annealed Nb-44% Ti rod. A formula has been derived by thermodynamic arguments for the specific heat of Type II superconductors as a function of temperature and the applied magnetic field. (MOW)

32241 (CONF-810853—1) Ideal transport in transition metals: the rigid-muffin-tin approximation and beyond. Butler, W.H. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE81028073.

From International conference on electron transport in metals; Ottawa, Canada (13 Aug 1981).

A recent calculation of the electrical and thermal resistivities of Nb and Pd due to electron-phonon scattering is reviewed. This calculation used the rigid-muffin-tin approximation and its results indicate that electron-phonon matrix elements calculated in this approximation are too weak at low momentum transfer. A formalism is developed for calculating the corrections to the rigid-muffin-tin approximation.

32242 (CONF-811003—2) Elevated-temperature (600°F), manual contact ultrasonic examination. Donnelly, C.W. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 1981. Contract AC15-76CL02395. 8p. NTIS, PC A02/MF A01.

From ASNT fall conference; Atlanta, GA, USA (12 Oct 1981).

Manual contact ultrasonic examination at temperatures above 250°F has not been successful in providing meaningful results. Sensitivity of standard transducers degrades rapidly at 250°F and above. It has been demonstrated that by using standard transducers and commercially available wedges and couplants in combination with a couplant/cooler system, manual contact ultrasonic examination can be performed at 600°F for an essentially 100% duty cycle in conformance to the sensitivity requirement of the ASME B and PV Code.

32243 (CONF-811019—1) Computer simulation of bulk and surface chemical diffusion of light atoms in metals. Murch, G.E. (Argonne National Lab., IL (USA)). 1981. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE81025159.

From Symposium on interatomic potentials and computer simulation of defects in metals; Pittsburgh, PA, USA (6 Oct 1981).

The lattice gas as a model for interstitial solid solution and adsorption systems is reviewed with emphasis on the generation of ordered structures. Then, as a prelude to the main discourse on chemical diffusion, the tracer diffusion coefficient is discussed in conjunction with the presentation of Monte Carlo results. Next, chemical diffusion is treated in detail with emphasis on the Danken equation. Monte Carlo results are then presented for the chemical diffusion coefficient. The large maximum in the chemical diffusivity observed within the ordered phase is traced back to the very strong driving force provided by the chemical potential derivative.

32244 (CONF-811022—1) Estimate of the contribution of load transfer to the yield strength and hardness of a dual-phase steel. Gurland, J. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jun 1981. Contract AC02-80ER10556. 14p. (COO—3084/83). NTIS, PC A02/MF A01. Order Number DE81025545.

From Conference on effects of interfaces on deformation and fracture; Louisville, KY, USA (11 Oct 1981).

The ratio of the average stresses in ferrite and martensite at yield of a dual-phase steel is calculated from a shear-lag model of load transfer, based on a shape parameter of the martensite particles. For a specific steel, a stress ratio of 2.2 is determined. This value is compared to the stress ratio obtained from hardness and microhardness determinations. The results qualitatively and tentatively support the strengthening role of load transfer in dual-phase steels.

32245 Band edge singularities and the surface density of states in Nb(110). Smith, R.J. (Brookhaven National Lab., Upton, NY (USA)). *Solid State Communications ;* **37**: No. 9, 725-727(Mar 1981).

Photoemission measurements of the Nb (110) surface show surface sensitive structure near the Fermi energy which can be attributed to bulk band structure effects persisting right out to the surface layer. This is in agreement with recent layer density of states calculations for Mo (110).

32246 (DOE/ER/01367—T1) Effect of point defects on mechanical properties of metals. Technical progress report, September 1, 1980-July 31, 1981. Meshii, M. (Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering). Jul 1981. Contract AS02-76ER01367. 4p. (COO—1367-130). NTIS, PC A02/MF A01. Order Number DE81028882.

Current research activities are in two areas, low temperature plastic deformation of niobium and niobium-oxygen single crystals, and the effect of hydrogen on the plastic deformation and fracture of iron.

32247 **Material behaviour and physical chemistry in liquid metal systems. Abstracts.** Karlsruhe, Germany, F.R.; Fachinformationszentrum Energie, Mathematik, Physik (1981). 59p.

Book of substracts containing contributions in the field of sodium corrosion and mass transfer, lead and lithium corrosion, interstitial elements transfer, material behaviour, chemical reactions, physical and analytical chemistry, and solubility in alkali metals.

32248 **(GA-A—16144) Fatigue-life prediction for a copper alloy degraded by multiple flaws.** Sweig, R.A. (General Atomic Co., San Diego, CA (USA)). Jul 1981. Contract AT03-80SF11512. 58p. NTIS, PC A04/MF A01. Order Number DE81029949.

A study to establish fatigue life prediction for alloy 155 copper degraded by multiple flaws is described. Twelve specimens with natural flaws were radiographically characterized and fatigue tested to failure in a manner which minimized data scatter. Disposition of defective alloy 155 copper plate stock and Doublet III B-coil machined center post components was based on radiographically determined flaw size. Along with the macroscopic vertical internal flaws detected by radiography, undetectable microscopic alloy segregations were present in the microstructure. Data scatter, including microscopic flaw distribution, was related to radiographically detectable flaw size, and the reliability of the radiographic method was evaluated. B-coil fatigue lives for various load conditions were predicted. B-coil life expended to date and useful life remaining are discussed.

32249 **(HEDL-SA—2257-FP) Irradiation-induced swelling in commercial alloys.** Bates, J.F.; Powell, R.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1980. Contract AC14-76FF02170. 38p. NTIS, PC A03/MF A01. Order Number DE81029755.

Examination of a wide range of commercial alloys indicates that a minimum in swelling occurs at 40 to 50% nickel. Swelling in these alloys was measured after irradiation to peak fluences of 14.7 x 10^{22} n/cm^2 (E > 0.1 MeV) at temperatures ranging from 400 to 650°C. The minimum in swelling extends over the full range of irradiation test temperatures. Swelling in the alloys appears to be more sensitive to preirradiation aging treatments than to relative position on the Fe-Cr-Ni ternary diagram. Preirradiation aging of an alloy removes swelling inhibitors from the matrix with a consequent increase in swelling. One of the more important swelling inhibitors removed is carbon. Carbon in solution in the configuration of atomic complexes, which may contain both lattice defects and carbon atoms, can reduce swelling by screening of the dislocation stress fields and hence cause a reduction in the dislocation-interstitial bias factor. A reduction in swelling with increasing equavilant chromium content was also observed. 16 figures, 4 tables.

32250 **(KAPL—4143) Heat-treatment parameters for the aging of Alloy 625.** Hayes, S.C. (Knolls Atomic Power Lab., Schenectady, NY (USA)). Sep 1981. Contract AC12-76SN00052. 52p. NTIS, PC A04/MF A01. Order Number DE81030005.

An investigation was undertaken to determine a set of heat-treatment parameters for the aging of Alloy 625 to a minimum yield strength of 100 ksi. The Box-Hunter technique of response surface analysis was employed to determine the relationship of the yield strength to the five heat-treatment parameters: the anneal/solution-treatment temperature, the nucleation-treatment temperature and time, and the final aging temperature and time. It was found that Alloy 625 that has a high niobium/carbon ratio and has been hot-finished to retain massive precipitated carbides can be aged to a minimum yield strength of 100 ksi in as little as 20 hr at 1200°F. The tensile properties of aged material were measured at temperatures to 700°F, and the thermal stability was confirmed by exposure for 10,000 hr in 600°F air with no change in room temperature tensile properties.

32251 **(LA-UR—81-2338) Relaxation effects in shock-induced transitions in bismuth.** Neal, T.R. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810827—6). NTIS, PC A02/MF A01. Order Number DE81028728.

From 8. AIRAPT conference and 19. EHPRG conference; Uppsala, Sweden (17 Aug 1981).

The indication given by the baratol experiments is that as the shock in the mixed region progresses and decays, the lead state does not change along a stable Hugoniot but appears to change from a sort of metastable Hugoniot, in accordance with Romain's data, to a stable Hugoniot reminiscent of the earlier results. If this is so, then the Bi I-III transition is exhibiting a relaxation effect similar to that seen in the Sb I-III transition. The transition detected by Romain could then be interpreted as the II-III transition seen in the metastable region. The few experiments outlined here merely hint at an explanation. Additional precision work in the stress range 6-10 GPa, some with thin samples, is needed to resolve this behavior.

32252 **(LBL—11628) Role of dislocation theory in the design of engineering materials.** Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Jun 1980. Contract W-7405-ENG-48. 57p. (CONF-800696—3). NTIS, PC A04/MF A01. Order Number DE81028127.

From International conference on dislocation modeling of physical systems; Gainesville, FL, USA (22 Jun 1980).

The science of materials development has progressed to a stage in which it is possible to compose a recipe for new materials. The recipe has three steps: given a desirable set of properties and material constraints, one identifies a composition and microstructure to achieve them; given a desirable composition and microstructure, one identifies a processing sequence to achieve them; given a trial alloy, one conducts analytical testing to identify its shortcomings and overcomes them. In effecting each stage of this recipe, it is usually necessary to be aware of and understand the role of the dislocations which determine material properties, define material microstructure, and control its evolution. The role of dislocations is discussed. The text contains examples of particular alloy development efforts, and suggestions for research in dislocation theory which might contribute to the solution of significant problems in materials development.

32253 **(LBL—12177) Microstructure and properties of dual-phase steels containing fine precipitates.** Gau, J.S.; Koo, J.Y.; Nakagawa, A.; Thomas, G. (Lawrence Berkeley Lab., CA (USA); Exxon Research and Engineering Co., Linden, NJ (USA). Corporate Research Science Lab.). Jul 1981. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01. Order Number DE81029946.

Very fine particles (carbides or carbonitrides) of the order of 20 A were extensively examined in the ferrite regions of dual-phase steels subjected to intercritical annealing followed by fast quenching to room temperature. These particles are probably formed during quenching after intercritical annealing. The driving force for the precipitation reaction may arise from the supersaturation of carbon (or nitrogen) in the ferrite phase. These precipitates in certain alloy compositions cause a deviation from the generally observed two phase mixture rule in that the strength of the dual-phase steels having a higher volume fraction of martensite is lower than that having a lower volume fraction of martensite. Thus, the influence of such precipitates must be considered in the structure-property relations of dual-phase steels when fast quenching is employed after intercritical annealing.

32254 **(ORNL—5781) Effect of microstructure on the susceptibility of low-alloy steels to hydrogen attack.** Williams, R.O. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 52p. NTIS, PC A04/MF A01. Order Number DE81028030.

In an alloy steel in which one or more alloy additions stabilize the carbide phase, the carbon activity depends on the microstructure and the prior thermal history. The carbon activity is a major factor in the susceptibility of such steels to form internal methane bubbles when heated in high-pressure hydrogen. Thus one can expect to vary the susceptibility to hydrogen attack of a given steel by its prior treatment. The problem has two aspects. First, one needs to be able to calculate the equilibrium carbon activity when the steel is in internal equilibrium. A computer program in the appendix of this report takes care of part of this problem. When the thermodynamics of the mixed carbide phase is adequately modeled, then this problem can be solved. The second part is the rate of approach to equilibrium. An analysis of the rate of coarsening of car-

bides in such steels shows that this rate is enhanced by a fine carbide dispersion. Such a fine dispersion is also desirable for the maximum strength. Thus, we believe that under favorable circumstances the resistance to hydrogen attack can be enhanced by suitable thermal treatments of the steels used for the pressure vessels for hydrogen service. 12 figures.

32255 **(PNL-SA—8969A) Sputter deposition with nearly-parallel coating flux.** Patten, J.W.; McClanahan, E.D.; Moss, R.W.; Bayne, M.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1981. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01. Order Number DE81030107.

A method for producing a dense, nearly-parallel flux of sputtered atoms is described. This method allows sputter depositing films having substantially 100% of theoretical density. The sputtering chamber contains a target having a surface that is substantially parallel to the direction of the particles impinging upon the substrate surface, the distance between the most remote portion of the substrate surface receiving the particles and the target surface emitting the particles in a direction parallel to the substrate surface being relatively small. The pressure in the vessel is maintained less than about .65 Pa to limit scattering and permit line-of-sight deposition. The angles of incidence of the particles impinging upon the substrate surface do not vary greatly even when the target surface area is greatly expanded to increase the deposition rate. An experimental sputtering system is described. Deposition rates are given as a function of distance from the target edge and distance from the target plane. Metallography of sputter deposited Ni is presented.

32256 **(PNL-SA—9285) Effect of pulsed irradiation on void swelling in nickel.** Brimhall, J.L.; Charlot, L.A.; Simonen, E.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 5p. (CONF-810831—23). NTIS, PC A02/MF A01. Order Number DE81028004.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

This study has compared the void microstructure in nickel induced by a pulsed ion bombardment to that induced by a steady-state irradiation. Pulse cycles of 10 seconds on and 10 seconds off produced no measurable difference in the void growth and swelling in the temperature range 775 to 975°K compared to continuous irradiation at the same instantaneous dose rate. Void annealing during the pulse annealing period was minimal due to the large void sizes which were obtained in these irradiations. Hence no measurable effect of pulsing on void growth was observed.

32257 **(PNL-SA—9293) Radiation-induced segregation in candidate fusion-reactor alloys.** Brimhall, J.L.; Baer, D.R.; Jones, R.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 6p. (CONF-810831—22). NTIS, PC A02/MF A01. Order Number DE81028005.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The effect of radiation on surface segregation of minor and impurity elements has been studied in four candidate fusion reactor alloys. Radiation induced surface segregation of phosphorus was found in both 316 type stainless steel and in Nimonic PE-16. Segregation and depletion of the other alloying elements in 316 stainless steel agreed with that reported by other investigators. Segregation of nitrogen in ferritic HT-9 was enhanced by radiation but no phosphorus segregation was detected. No significant radiation enhanced or induced segregation was observed in a Ti-6Al-4V alloy. The results indicate that radiaton enhanced grain boundary segregation could contribute to the embrittlement of 316 SS and PE-16.

32258 **(PNL-SA—9546) H_2S adsorption of plasticity strained iron.** Thomas, M.T.; Baer, D.R.; Jones, R.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 8p. (CONF-810584—2). NTIS, PC A02/MF A01. Order Number DE81027996.

From NATO advanced study institute on atomistics of France; Corsica, France (22 May 1981).

The purpose of this paper is to present data showing an increased adsorption rate for H_2S on plastically strained iron. There has been considerable speculation in the literature concerning the effect of strain on the enhanced corrosion and surface reactivity, but there has been no direct experimental evidence that strain does increase surface reactivity. To understand the possible effects of strain enhanced adsorption on crack initiation and growth is the main motivation for these studies. It is realized that strain enhanced adsorption may also be important for catalytic corrosion and wear properties of materials.

32259 **(RHO-BWI-ST—15) Corrosion tests of canister and overpack materials in simulated basalt groundwater.** Anderson, W.J. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). May 1981. Contract AC06-77RL01030. 19p. NTIS, PC A02/MF A01. Order Number DE81024182.

Corrosion tests of candidate container materials for nuclear waste in a simulated basalt environment are in progress. Test conditions in the first series of autoclave tests were 250°C temperature, 5.8 MPa pressure, with simulated groundwater (oxygen fugacity ca 10^{-50} MPa, pH ca 9.5). Control of oxygen fugacity of the water was obtained by use of an argon/hydrogen mixture in the test chamber and in the solution reservoir. Periodic sampling and analysis of the test solution were used to monitor the efficacy of the control of water chemistry and the products of specimen corrosion. Materials placed under test included titanium, nickel, copper, and iron-based alloys identified as potentially useful for either canister or overpack containers in the engineered barrier system concept. Results regarding control of water composition and material corrosion in the initial phase of testing are presented.

32260 **(SAND—80-1442C) Potential of thermomechanical processing of dilute uranium alloys.** Eckelmeyer, K.H. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 23p. (CONF-811001—1). NTIS, PC A02/MF A01. Order Number DE81009797.

From 2. Charlottesville Conference on high density penetration materials; Charlottesville, VA, USA (14 Oct 1981).

Preliminary results of studies on uranium-2.25 wt % niobium and uranium-0.75 wt % titanium suggest that thermomechanical processing of dilute uranium alloys might: (1) eliminate the need for quenching to obtain moderate yield strengths (~ 900 MPa), (2) provide higher usable yield strengths (> 1050 MPa). Analysis of the stress-strain curve of annealed uranium-2.25% niobium indicates that deformation hardening should produce substantial increases in yield strength with very small decreases in ductility. Preliminary rolling experiments reveal that this material can be successfully warm worked over a wide range of conditions. Analysis of the stress-strain curve of solution treated uranium-0.75% titanium indicates that deformation hardening should produce better combinations of yield strength and ductility than can be obtained by age hardening. Preliminary rolliing experiments demonstrate that this alloy can be uniformly hardened at temperatures below 300°C and that the hardening effects of deformation and aging are approximately additive.

32261 **(SAND—81-0378C) Pressure-shear loading of materials.** Chhabildas, L.C.; Swegle, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810827—7). NTIS, PC A02/MF A01. Order Number DE81028250.

From 8. AIRAPT conference and 19. EHPRG conference; Uppsala, Sweden (17 Aug 1981).

A novel technique involving the use of Y-cut quartz crystals for simultaneous dynamic longitudinal and shear loading of materials will be described. The coupled longitudinal and shear motion generated within the Y-cut crystal (upon impact) is transmitted into a sample bonded to its rear surface and is monitored using velocity interferometer techniques. Experimental results on pressure-shear loading of aluminum and alumina-filled epoxy are given here.

32262 **(SAND—81-0379C) Viscoplastic response of beryllium under shock compression.** Asay, J.R.; Chhabildas, L.C.; Wise, J.L. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810827—8). NTIS, PC A02/MF A01. Order Number DE81028248.

From 8. AIRAPT conference and 19. EHPRG conference; Uppsala, Sweden (17 Aug 1981).

In the present work, plane shock wave techniques were used to determine the effective viscosity of beryllium over a strain-rate regime of about 1 to 60 μs^{-1}. Viscosity coefficients were derived from risetime measurements on steady shock waves produced by initial compression of specimens from the ambient state, and also from measured risetimes of reloading waves produced by recompression from the initial shocked state. These results indicate that the effective viscosity appropriate to initial shock loading decreases from about 190 Pa-s (1900 poise) at a strain rate of 1 μs^{-1} to about 40 Pa-s at a strain rate of about 60 μs^{-1}. Results obtained from recompression experiments indicate an increase in viscosity over that obtained for initial compression.

32263 **(UCRL—85554) Polarization study of hot corrosion phenomena in Ni-Cr alloys.** Truhan, J.J.; Jeys, T.R. (Lawrence Livermore National Lab., CA (USA)). 17 Aug 1981. Contract W-7405-ENG-48. 23p. (CONF-810943—3). NTIS, PC A02/MF A01. Order Number DE81029609.

From Conference on chemistry of materials at high temperatures; Harwell, Oxfordshire, UK (7 Sep 1981).

Electrochemical polarization was used to study the hot corrosion of nickel-chromium binary alloys in molten sodium sulfate at 900°C. The advantages of using this technique to study hot corrosion compared to thermogravimetric analysis include accelerated oxidation by anodic polarization, rapid determination of corrosion rates, and quantitative measures of the stability of protective scales. By systematically studying the effect of alloy composition, the primary mode of corrosion change from nickel oxidation and sulfidation to chromium oxidation was observed. A coherent protective chromium oxide scale forms on alloys containing at least 15 to 20 wt % chromium, and only a marginal increase of protection is realized using additional chromium.

32264 **Ion scattering characterization of the oxidation of thin copper films on gold substrates.** Miller, A.C. (Alcoa Technical Center, Alcoa Center, PA); Czanderna, A.W. *Applications of Surface Science ;* **4**: 481-491(1980).

The oxidation and interfacial behaviors of a vacuum deposited thin copper film/gold foil substrate system were studied by using ion sputtering (ISS) to obtain composition in-depth profiles of the oxide layer and the overlayer/substrate interface. Oxidations were carried out in air at 140°C for time periods of 0.5, 1, 3, 6, 13 and 72 h. In order to reduce crater edge effects and to obtain a better approximation to the actual composition at the bottom of the advancing crater, an analytic cratering analysis technique was applied to the raw data. The corrected depth profiles indicated that significant diffusion had occurred at the Cu/Au interface after 30 min of heating. The data are easily understood if in the initial stages both copper oxidation and copper-gold diffusion can occur simultaneously at the air/film and film/substrate interfaces, respectively. In the later stages, copper diffuses out of the Cu-Au alloy and migrates through the oxide layer to complete the formation of the oxide at the surface.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 31708, 31999, 32092, 32092, 32146, 32146, 32148

32265 **(ANL-CEN-RSD—81-1) Vapor pressures and vapor compositions in equilibrium with hypostoichiometric uranium dioxide at high temperatures.** Green, D.W.; Leibowitz, L. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-48. 44p. NTIS, PC A03/MF A01. Order Number DE81029954.

Thermodynamic functions of the gaseous species, thermodynamic functions of the condensed phase, and an oxygen-potential model have been combined to calculate the vapor pressures and vapor compositions in equilibrium with condensed-phase UO/sub 2-x/ for $1500 \leqq T \leqq 6000$ K and $0 \leqq x \leqq 0.5$. A method for extending the oxygen-potential model of Blackburn to the liquid region has been derived and evaluated. New thermodynamic functions of the UO_2 condensed phase have been derived from the best available data, including the heat capacity recommended by Fink.

32266 **(CONF-810746—1) Fracture toughness of Al_2O_3-ZrO_2 composites.** Becher, P.F.; Tennery, V.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE81028575.

From International symposium on the fracture mechanics of ceramics; University Park, PA, USA (15 Jul 1981).

K/sub IC/ of Al_2O_3-ZrO_2 two-phase ceramic composites was determined for different ZrO_2/Al_2O_3 ratios and selected Y_2O_3 stabilizer concentrations in the ZrO_2. The double cantilver beam (DCB) specimen geometry was used. In composites containing 20 vol % ZrO_2, K/sub IC/ increases (4.6 to 8.5 MPa m/sup 1/2/) with decrease in Y_2O_3 content from 3 to 1 mol %. On the other hand, composites containing 30 vol % ZrO_2, decreasing Y_2O_3 additions from 3 to 2 mol % leads to a maximum in K/sub IC/ value of about 6.2 MPa m/sup 1/2/ which occurred in a composition containing 2 mol % Y_2O_3. In this same composite, this maximum shifts to a value of about 8 MPa m/sup 1/2/ at about 2 to 3 mol % Y_2O_3 at ~195°C. These observations are consistent with a transformation toughening model wherein an increase in toughness occurs with decrease in Y_2O_3 content due to a decrease in the chemical free energy required for the transformation of tetragonal ZrO_2 to the monoclinic form. The K/sub IC/ also exhibits a maximum with the concentration of ZrO_2 particles and this maximum in K/sub IC/ increases in value and shifts to higher ZrO_2 contents wih Y_2O_3 stabilizer concentrations of 2 mol %. The increase in K/sub IC/ with ZrO_2 content results from the resultant increase in the number of ZrO_2 particles which transform to the monoclinic phase during crack propagation. Microstructural analyses indicate the preexisting extended microcracks are produced along the alumina grain boundaries when larger ZrO_2 particles at the boundaries transform to the monoclinic phase during cooling subsequent to densification. Such extended microcracking results in a reduction of toughening when linking of microcracks occurs. Microcracks also form at the intersection of ZrO_2 transformation twins within the particles and the ZrO_2 particle interface with other ZrO_2 grains or Al_2O_3 grains.

32267 **(DOE/ER/02995—5) Imaging of surfaces and defects of crystals. Progress report, June 1, 1980-June 30, 1981.** Cowley, J.M. (Arizona State Univ., Tempe (USA). Dept. of Physics). Jun 1980. Contract AS02-76ER02995. 28p. NTIS, PC A03/MF A01. Order Number DE81028482.

The techniques of imaging, microdiffraction and electron energy loss spectroscopy (EELS) have been applied to the study of the structure of thin oxide films on metals and the structure of the surfaces of oxide crystals. The special attachments which have been added to the HB5 scanning transmission electron microscopy (STEM) instrument have allowed the extension of the capabilities of these techniques so that the data obtained in these investigations is more extensive than that from any other instrument and allows new insights into the nature of surface layers.

32268 **(DOE/OR/20679—T5) High-temperature applications of structural ceramics. Quarterly progress report, April-June 1981.** Fuller, E.R.; Fields, R.J.; Chuang, T.J.; Dragoo, A.; Schneider, S.J. (National Bureau of Standards, Washington, DC (USA). Center for Materials Science). 1981. Contract AI05-80OR20679. 10p. NTIS, PC A02/MF A01. Order Number DE81028939.

The achievement of higher efficiency thermochemical engines and heat recovery systems requires the availability of high temperature, high performance structural materials. Structural ceramics such as SiC, Si_3N_4 and certain Al_2O_3-Si_3N_4 combinations have received particular attention for these applications due to their basic characteristics of good strengths coupled with good corrosion and thermal shock resistances. Information is presented concerning the high temperature fracture of structural ceramics; crack growth mechanism maps; microstructure and phase alteration; and microstructure and fracture in reactive environments.

32269 **(PNL—3913) Assessment of radiation effects in defense transuranic waste forms.** Roberts, F.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01. Order Number DE81029432.

The actinide concentrations of the defense transuranic (TRU) wastes were analyzed and the potential effects of the radi-

ation on the properties of the wastes after conversion to immobile forms were assessed. The study focused on the contact-handled retrievably-stored wastes. The major components of the current inventory are defense plutonium-contaminated wastes containing various amounts of ^{241}Am. The wastes stored at Idaho National Engineering Laboratory (INEL) are typical of the wastes in this category. There is also a substantial amount of wastes contaminated with plutonium enriched in ^{238}Pu arising from the Department of Energy's isotopic heat-source programs. Most of these wastes are stored at the Los Alamos National Laboratory (LANL) and the Savannah River Plant (SRP) sites. Four reference wastes were selected representing a credible range of actinide activities and were used for estimating radiation doses to the final waste forms based on: INEL first stage sludge, a composite of all wastes at INEL, a composite of all wastes at LANL including both defense and heat source plutonium wastes, and a composite of all heat-source plutonium wastes at SRP free from defense plutonium. From integrated alpha and beta-gamma doses over a 10^5y storage period, it is concluded that: accumulated beta-gamma doses of 10^6 to 10^8 rad over a 10^5 y storage period will not significantly change physical properties of the waste form. The alpha decay doses are 3-30 x 10^{16} decays/cm^3 (up to 3 x 10^{10} rad ionizing radiation from alpha particles) accumulated over a 10^5 y storage period. Radiolytic gas generation can be substantial in waste forms containing water or organic materials. The effect of leachant radiolysis on the leachabilities of TRU waste forms is not sufficiently understood to rule out the need for testing with actinide-doped specimens.

32270 (SAND—81-0291C) Temperature dependence of H saturation and isotope exchange. Doyle, B.L.; Wampler, W.R.; Brice, D.K. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810831—34). NTIS, PC A02/MF A01. Order Number DE81026633.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The retention, release, and isotope exchange of ion implanted hydrogen and deuterium in carbon and TiC have been investigated as a function of temperature. The implantations were performed both at room and elevated temperatures. In addition, samples implanted at room temperature were annealed isochronally to measure the thermal release of hydrogen. The results of the experiments indicate that both the saturation and isotopic exchange properties of hydrogen have significant temperature dependence.

32271 Development of magnetic order in superconducting systems. Moncton, D.E. (Bell Labs., Murray Hill, NJ (USA)); Shirane, G.; Thomlinson, W. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Magnetism and Magnetic Materials ;* **14**: 172-178(1979).

From International conference on neutron scattering and magnetism; Juelich, Germany, F.R. (29 - 31 Aug 1979).

Two different classes of rare-earth (RE) ternary superconductors ($RERh_4B_4$ and $REMo_6X_8$,X = S,Se) have provided the first instances in which chemically ordered sublattices of magnetic ions exist in superconductors. Neutron scattering studies show that simple, conventional antiferromagnetism coexists with superconductivity in a number of systems, while destruction of superconductivity occurs with the onset of ferromagnetism. We summarize the magnetic structural details for the coexistent antiferromagnets, and review measurements on the superconducting → ferromagnetic transition in $ErRh_4B_4$.

3603 Composite Materials

REFER ALSO TO CITATION(S) 32082

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 32323

32272 (MLM—2836(OP)) Characterization of radiation-crosslinked, high-density polyethylene for thermal energy storage applications. Whitaker, R.B.; Craven, S.M.; Etter, D.E.; Jendrek, E.F. (Mound Facility, Miamisburg, OH (USA)). 1981. Contract AC04-76DP00053. 8p. (CONF-811014—1). NTIS, PC A02/MF A01. Order Number DE81024915.

From 11. North American Thermal Analysis Society conference; New Orleans, LA, USA (19 Oct 1981).

This study is directed toward characterization of the crosslinked, form-stable high-density polyethylene (HDPE) pellets produced by electron beam radiation crosslinking, and the effects of crosslinking on crystallinity and heat of fusion. Methods used include differential scanning calorimetry (DSC), Fourier Transform Infrared Spectroscopy (FTIR), and x-ray diffraction measurements. DSC measurements of the heats of fusion (ΔH/sub f/) of the radiation-crosslinked HDPE showed that while a substantial decrease in ΔH/sub f/ occurred after the first melting cycle, slow cooling on recrystallization of the pellets could restore the ΔH/sub f/ value to ≧ 95% of that of the uncrosslinked HDPE up to 9.0 Mrad dosage exposure. The form stability of the 9.0-Mrad HDPE was very good even after 500 melt-freeze cycles in ethylene glycol. However, some further decline in ΔH/sub f/ was noted and more extensive thermal cycling tests would be required to verify this. X-ray diffraction measurements showed little or no difference in crystallinity among the various radiation-crosslinked HDPE's and the uncrosslinked control HDPE. This indicates the crosslinking occurs primarily in the amorphous regions of the polyethylene. FTIR spectroscopy was used to estimate the relative amounts of crosslinking occurring with the varying radiation dosages, and the uniformity of crosslinking throughout the pellets. The relative amount of crosslinking was based on the ratio of the 965 cm^{-1} absorption band to the 909 cm^{-1} band. This ratio did increase with increasing radiation dosage: from 1.9 for the crosslinked HDPE dosed with 9.0 Mrad, to 5.3 for that dosed with 18.0 Mrad. Also, the amount of crosslinking from the outside to the center of the pellets was found to be uniform, which would assist in maintaining long-term form stability in the pellets.

3606 Other Materials

REFER ALSO TO CITATION(S) 31695, 31698, 32006, 32269, 32386

32273 (BDX—613-2675) Process scale-up for thermally stable molding compounds. Young, D.A. (Bendix Corp., Kansas City, MO (USA)). Aug 1981. Contract AC04-76DP00613. 24p. NTIS, PC A02/MF A01. Order Number DE81030201.

Trial runs were made at an independent research laboratory to demonstrate the scale-up from a batch to a continuous process for the preparation of silicone- and polyimide-based molding compounds. Coatings were applied in two stages to both a fiberglass cloth and mat. Molding tests on the product were used to substantiate the cure conditions needed for each coating. The knowledge obtained provided the information needed for planning a proposed production facility to prepare these molding compounds.

32274 (CONF-810831—15) Mechanical strength of low-temperature-irradiated polyimides: a five-to-tenfold improvement in dose resistance over epoxies. Coltman, R.R. Jr.; Klabunde, C.E. (Oak Ridge National Lab., TN (USA)). Jun 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE81025469.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Neutronics calculations by Engholm show that without additional shielding even the first sion test reactors such as the Fusion Engineering Device will produce lifetime doses at magnet insulator locations that exceed the radiation tolerance of glass-fabric-filled (gff) epoxies now used. To explore the possible use of an alternative insulator, the mechanical strength of pure and recently available gff polyimides was studied as a function of gamma-ray irradiation at 4.9 K to 100 MGy (10^{10} rads). After a postirradiation anneal at 307°K the flexure and compressive strengths of the gff materials measured at 77°K were reduced by up to 40% for 100 MGy while the pure material changed little. Testing done at 300°K gave simi-

lar results, but all stress values were about 40% less. Compared to earlier epoxy studies we find that, overall, the gff polyimides are 5 to 10 times more radiation resistant than comparably prepared gff epoxies.

32275 (CONF-810851—1) Superconducting critical current density as a probe of defects in metallic glasses. Koch, C.C.; Scarbrough, J.O.; Kroeger, D.M. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE81028138.

From 4. international conference on rapidly quenched metals; Sendai, Japan (24 Aug 1981).

The influence of cold rolling on J/sub c/ in amorphous ($Mo_{0.6}Ru_{0.4})_{82}B_{18}$ is reported. Furthermore, more extensive characterization of the samples by transmission electron microscopy, scanning electron microscopy, and small angle x-ray scattering is presented. (GHT)

32276 (LBL—13040) Sub-gap and band edge optical absorption in a-Si:H by photothermal deflection spectroscopy. Jackson, W.B.; Amer, N.M. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 4p. (CONF-810719—2). NTIS, PC A02/MF A01. Order Number DE81028040.

From 9. international conference on amorphous; Grenoble, France (2 Jul 1981).

Using photothermal deflection spectroscopy, the optical absorption of various a-Si:H films was investigated in the range of 2.1 to 0.6 eV. An absorption shoulder which depends on deposition conditions and on doping was found and was attributed to dangling bonds. The exponential edge broadens with increasing spin density.

32277 (PNL—3550) Evaluation of defense-waste glass produced by full-scale vitrification equipment. Lukacs, J.M.; Petkus, L.L.; Mellinger, G.B. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1981. Contract AC06-76RL01830. 102p. NTIS, PC A06/MF A01. Order Number DE81030408.

Three full-scale vitrification processes at the Pacific Northwest Laboratory produced over 67,000 kg of simulated nuclear-waste glass from March 1979 to August 1980. Samples were analyzed to monitor process operation and evaluate the resulting glass product. These processes are: Spray Calciner/In-Can Melter (SC/ICM); Spray Calciner/Calcine-Fed Ceramic Melter (SC/CFCM); and Liquid-Fed Ceramic Melter (LFCM). Waste components in the process feed varied less than +- 10%. The SC/ICM and SC/CFCM which use separate waste and frit feed systems showed larger glass compositional variation than the LFCM, which processed only premixed feed during this period. The SC/ICM and SC/CFCM product contained significant amounts of acmite crystals, while the LFCM product was largely amorphous. In addition, the lower portion of all SC/ICM-filled canisters contained a zone rich in waste components. A product chemical durability as determined by pH4 and soxhlet leach tests varied considerably. Aside from increased durability under pH4 conditions with decreasing waste content, glass composition, microstructure and melting process did not correlate with glass durability. For all samples analyzed, the weight loss under pH4 conditions ranged from 17.7 to 85.2 wt %. Soxhlet conditions produced weight losses from 1.78 to 3.56 wt %.

32278 (SAND—81-0061C) Microwave dielectric constant of shock-loaded lithium niobate. Hartman, J.K.; Wise, J.L.; Graham, R.A.; Johnson, R.O.; Clark, G.E.; Burns, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 10p. (CONF-810684—49). NTIS, PC A02/MF A01. Order Number DE81028414.

From APS conference on shock waves in condensed matter; Menlo Park, CA, USA (23 Jun 1981).

The microwave dielectric constant of single-crystal, Z-cut LiNbO3 has been measured in a sample subjected to a 35 GPa impact loading. Interpretation of the measurements indicates that the average dielectric constant behind the shock wave is a factor of 3 larger than the initial value.

32279 (SAND—81-0590C) Thin film adhesion and deadhesion. Mattox, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 8p. (CONF-811029—1). NTIS, PC A02/MF A01. Order Number DE81028415.

From International Society for Hybrid Microelectronics meeting; Chicago, IL, USA (12 Oct 1981).

A practical definition of good adhesion is that the interfacial region (or nearby material) does not fail under service conditions nor at unacceptably low stress levels under test conditions. Adhesion is a macroscopic property of the system and the failure of adhesion or deadhesion involves failure of large areas of material the surfaces of which rarely separate at a sharp boundary between two materials. The energy necessary to cause deadhesion may be likened to the fracture energy in the fracture of bulk materials. Good adhesion is prompted by: (1) strong bonding in the interfacial region, (2) absence of high stresses, (3) absence of easy fracture modes, and (4) no long-term degradation modes. Each of these factors may be influenced by the materials involved, the deposition method used, the deposition parameters and the service/test conditions. This paper will review a number of factors which determine the adhesion of film-substrate systems and will attempt to outline some methods for resolving adhesion problems.

32280 (SAND—81-0819C) Ion-implantation effects in glasses. Arnold, G.W. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 37p. (CONF-8106132—1). NTIS, PC A03/MF A01. Order Number DE81027208.

From International conference on radiation effects in glasses; Arco, Italy (30 Jun 1981).

Ion implantation can be used to introduce network damage and to alter the chemical composition in glasses. Structural changes can be inferred from IR measurements near 1000 cm^{-1} and by optical absorption near 2150 A. Implantation induced damage decreases the implanted volume in fused silica with consequent changes in the refractive index, near-surface hardness, and surface tensile stress. Prior work in these areas is reviewed. Implantation into alkali silicate glasses depletes the alkali content in the implanted region. These changes allow preferential surface crystallization in $Li_2O \cdot 2SiO_2$ glasses. Crystallization of amorphous SiO_2 can be induced by implantation of Li. Insight into the crystallization process is obtained by observing the associated ion movement using elastic recoil detection (ERD) and optical techniques. Implantation of 20 keV H shows that saturation of implanted H-sites in fused silica occurs at about 2.2×10^{21} H/cm^3 in agreement with estimates of the number of available interstitial sites. Details of H and D interactions in fused silica were studied as a function of fluence and temperature. Results are of interest to studies of corrosion in glasses considered for nuclear waste encapsulation and for components in fusion reactors.

32281 (UCRL—15358) Development of BK-3-PS borosilicate optical glass with integral antireflective surfaces. Final report, September 8-March 8, 1980. Cook, L.M. (Lawrence Livermore National Lab., CA (USA)). 1980. Contract W-7405-ENG-48. 52p. NTIS, PC A04/MF A01. Order Number DE81030011.

Lawrence Livermore National Laboratory has expressed its desire to develop a process to produce high optical quality integral antireflective surfaces for passive components of the SHIVA/NOVA Laser System. Because of their current program of frequency conversion of the present 1060 nm system to the doubling (530 nm) and tripling (353 nm) wavelengths, they are especially interested in the broad bandwidth gradient surfaces. Use of gradient AR surfaces would allow optical components to be used in frequency converted systems without being recoated, a considerable savings of both time and money. LLNL also requires a window material for frequency tripled systems to replace BK-7. Design specifications require window materials having 350 nm absorbance below 0.006 cm^{-1}. BK-7 in comparison has an absorbance of 0.030 cm^{-1} at best. Consequently, LLNL has asked Schott Optical Glass for development of an acceptable window material suitable for frequency tripled systems on which an integral antireflective surface may be produced. Highest interest was expressed in a glass suitable for production of gradient index coatings. A summary of recent development work in this area at Schott Optical Glass is presented.

32282 (UCRL—53143) Mechanical and thermophysical properties of hot-pressed SYNROC B. Hoenig, C.L.; Newkirk, H.W.; Otto, R.A.; Brady, R.L.; Brown, A.E.; Ulrich, A.R.; Lum, R.C. (Lawrence Livermore National Lab., CA (USA)). 6 May 1981. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01. Order Number DE81029299.

The optimal SYNROC compositons for use with commercial waste are reviewed. Large amounts of powder (about 2.5 kg) were prepared by convention al ceramic operations to test the SYNROC concept on a processing scale. Samples, 15.2 cm in diameter, were hot pressed in graphite, and representative samples were cut for microstructural evaluations. Measured mechanical and thermophysical properties did not vary significantly as a function of sample location and were typical of titanate ceramic materials.

32283 Novel graphite salts and their electrical conductivities. Bartlett, N. (Univ. of California, Berkeley); McCarron, E.M.; McQuillan, B.W.; Thompson, T.E. Contract W-7403-ENG-48. *Synthetic Metals ;* **1**: 221-232(1980).

From Symposium on the structure and properties of highly conducting polymers and graphite; San Jose, CA, USA (29 Mar 1979).

A set of novel first stage graphite salts of general formula $C_6^+ MF_6^-$ has been prepared (M = Os, Ir, As). Single crystal x-ray diffraction studies indicate that these salts are hexagonal with a ≃ 4.9 and c ≃ 8.1 A. The unit cell volume indicates that the anions are closely packed in the galleries. Platinum hexafluoride, which is the most powerful oxidizer of the third transition series, forms a first stage compound, which analytical, structural, and magnetic studies establish as $C_{12}^{2+} PtF_6^{2-}$. In this salt the anions are not close packed, but the electron withdrawal from the graphite planes is greater than for the $C_6^+ MF_6^-$ series. The variation in the electrical conductivity (in the a-b plane), as a function of composition, has been investigated with the OsF_6, IrF_6, PtF_6 and AsF_5 intercalates. For OsF_6 and IrF_6, the conductance per plane of graphite is found to be a maximum at approximately $C_{24}MF_6$ (second stage); the conductivity being an order or magnitude greater than that of the parent material. Intercalation beyond $C_{24}MF_6$ leads to a marked decrease in conductivity. C_8MF_6 is comparable in conductivity with the parent graphite. This behavior contrasts with the graphite/AsF_5 system in which a steady increase in conductance per graphite plane with increasing AsF_5 content is observed. For the PtF_6 system, the second as well as the first stage materials are poorly conducting.

40 CHEMISTRY

32284 (DOE/ER—0105) Summaries of FY 1981 research in the chemical sciences. (Department of Energy, Washington, DC (USA). Office of Energy Research). Aug 1981. 273p. NTIS, PC A12/MF A01. Order Number DE81030000.

The purpose of this booklet is to help those interested in research supported by the Department of Energy's Division of Chemical Sciences, which is one of six Divisions of the Office of Basic Energy Sciences in the Office of Energy Research. Chemists, physicists, chemical engineers and others who are considering the possibility of proposing research for support by this Division will find the booklet useful for gauging the scope of the program in basic research, and the relationship of their interests to the overall program. These summaries are intended to provide a rapid means for becoming acquainted with the Chemical Sciences program to members of the scientific and technological public and interested persons in the Legislative and Executive Branches of the Government. Areas of research supported by the Division are to be seen in the section headings, the index and the summaries themselves. Energy technologies which may be advanced by use of the basic knowledge discovered in this program can be seen in the index and again (by reference) in the summaries. The contents are as follows: DOE laboratires; chemical physics; atomic physics; chemical energy; separations; analysis; chemical engineering sciences; offsite contracts; equipment funds; topical index; institutional index for offsite contracts; and investigator index.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 31561, 31562, 31564, 31564, 31669, 31670, 31670, 31671, 31671, 31674, 31675, 31686, 31760, 31761, 31763, 32247, 32584

32285 (ANL—80-115-Part2, pp 97-105) Improved analytical procedure for the determination of ^{210}Pb and ^{210}Po using alpha-spectrometric isotope dilution. Urnezis, P.W.; Holtzman, R.B. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

An isotope dilution method has been incorporated into the ^{210}Pb-^{210}Po analysis. A known amount of ^{209}Po is added to the sample before analysis. Then both ^{209}Po and ^{210}Po are deposited on a silver planchet which is assayed in an alpha spectrometer to determine the activities of each isotope. The recoveries generally range from 70% to 90%.

32286 (CONF-810740—2) Systems background in x-ray microanalysis. Bentley, J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE81027285.

From 3. analytical electron microscopy workshop; Vail, CO, USA (13 Jul 1981).

A reasonable understanding now exists of the sources, effects and appropriate remedies of x-ray systems background in analytical electron microscopes. Although the systems background can never be eliminated completely, accurate quantitative analysis is still a realistic proposition for an informed experimentalist.

32287 (DOE/ER/10554—7) Development and optimization of methodologies for analysis fo complex hydrocarbon mixtures. Technical progress report, 1 September 1980-31 August 1981. Laub, R.J. (Ohio State Univ., Columbus (USA). Dept. of Chemistry). 1981. Contract AC02-80ER10554. 55p. NTIS, PC A04/MF A01. Order Number DE81025875.

Studies of rotating-disk thin-layer chromatography were continued from the previous grant period, and fundamental aspects of this newly-revived technique were examined in this period in some detail. A number of design innovations were explored, implementation of which could result in a separations system which rivals conventional-column lc for pre-analysis fractionation of petroleum. Studies with liquid-chromatographic (lc) columns of conventional dimensions examined the variation of retentions of aromatic hydrocarbon solutes with mobile phases of methanol + water (reversed-phase sorbent) and hexane + isopropyl alcohol (silica sorbent). The utility of ternary blends of hexane solvent + combinations of methylene chloride, tetrahydrofuran, acetonitrile, and isopropyl alcohol were also evaluated with silica adsorbent and polycyclic aromatic hydrocarbon solutes. Resolution of a small impurity in one of the solute mixtures was used to illustrate the effects of column temperature. Microbore reversed-phase column systems were examined from the standpoints of efficiency and analysis times. Optimization of conditions relating to the fabrication and use of open-tubular gc glass-capillary columns were continued. These efforts included studies of the controlled and predictable variation of retentions with composition of the (multi-component) stationary and mobile phases. Total analysis of a commercial gasoline provided illustration of the ultrahigh resolution available from the resultant column systems. Other studies included clean-up procedures for lc solvents, computer data acquisition and reduction techniques for gc and lc, detector and recorder distortion of chromatographic peaks in gc, and new methods of data presentation and pattern recognition for spectra of levels of complexity of those generated in this work.

32288 (DOE/ER/10554—8) Rotating-disk thin-layer chromatography. DuPont, D.L. (Ohio State Univ., Columbus (USA)). 1980. Contract AC02-80ER10554. 116p. NTIS, PC A06/MF A01. Order Number DE81025878.

Thesis.

Fundamental studies and applications of a new separations technique, rotating-disk thin-layer chromatography (RDTLC), are reported. The studies include evaluation of several packing methods, effects of silica activation on the reproducibility and related ef-

ficiencies of the chromatographic systems, and the utility of the instrument with regard to the fractionation of complex mixtures. Reproducibility is found to be excellent if the adsorbent activity is controlled. The technique is most advantageous when used for preparative separations. It is also shown to be useful in the clean-up of complex natural products for subsequent analysis.

32289 (ORNL—5806, pp 52-53) **Other biomedical and environmental programs.** Jul 1981. NTIS, PC A04/MF A01.

In Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.

Brief examples of some of the work done by the Analytical Chemistry, Chemical Technology, Computer Sciences, Energy, and Instrumentation and Controls Divisions are given. These divisions are part of the biomedical and environmental research programs at Oak Ridge National Laboratory. (KRM)

32290 **(PB—81-125189) Gas chromatographic determination method for carbon monoxide and methane.** Hoogereen, A.W. (Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft (Netherlands)). Feb 1976. 17p. (In Dutch). NTIS, PC A02/MF A01.

The purpose of this research is to develop a sensitive and good reproducible determination method for carbon monoxide. A sample of air is directed over a distillation column of molecular sieve, and then directed over a nickel catalyzer. On this nickel catalyzer, CO is transferred into methane in a hydrogen environment. By means of a flame ionization detector, the concentrations of methane and the into methane transferred carbon dioxide are determined.

32291 **(PNL-SA—9348) Advanced Gamma Scan System Software Package reference manual.** Schroeder, J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 53p. NTIS, PC A04/MF A01. Order Number DE81028094.

The AGSS is used to collect and analyze gamma spectra from reactor fuel pins. The AGSS Software Package operates on a minicomputer and controls a precision examination stage, multichannel analyzer and gamma radiation detector. In addition, the Software Package provides an operator interface to this system.

32292 **(RFP—3214) Direct analysis of plutonium metal for gallium, iron, and nickel by energy dispersive x-ray spectrometry.** Bramlet, H.L.; Doyle, J.H. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1981. Contract AC04-76DP03533. 10p. (CONF-810854—1). NTIS, PC A02/MF A01. Order Number DE81028046.

From X-ray analysis conference; Denver, CO, USA (3 Aug 1981).

An x-ray secondary target method for routine determination of gallium, iron, and nickel in plutonium metal is described that has significant advantages over wet chemical analysis. Coupons requiring minimal preparation for analysis are produced as a breakaway tab on the plutonium ingot. All three elements are determined on the same coupon. Gallium is determined using an arsenic secondary target followed by iron and nickel using a zinc target. The analysis times are 5 minutes for gallium and 15 minutes for the combined iron and nickel. The method of analysis was evaluated in the range of from 0.5 to 1.5% gallium. Iron was investigated over the range of 67 to 3000 ppM and nickel from 64 to 110 ppM.

32293 **(Y/DU—192) Surface analysis by Fourier-transform infrared (FTIR) spectroscopy.** Powell, G.L.; Smyrl, N.R.; Fuller, E.L. (Oak Ridge Y-12 Plant, TN (USA)). 12 Aug 1981. Contract W-7405-ENG-26. 32p. NTIS, PC A03/MF A01. Order Number DE81025741.

A diffuse-reflectance capability for the Fourier transform infrared spectrometer at the Y-12 Plant Laboratory has been implemented. A sample cell with a 25 to 400°C temperature-controlled sample stage and an ultrahigh-vacuum-to-atmospheric pressure gas-handling capability has been developed. Absorbance of light from the spectrometer beam, resulting from the beam being scattered from a powder sample, can be measured. This capability of detecting molecular species on and in powders is to be used to study chemisorption on actinide and rare-earth metals, alloys, and compounds. Cell design is described along with experiments demonstrating its performance in detecting moisture absorption on uranium oxide, moisture and carbon dioxide absorption on the lithium hydride/hydroxide system, and carbon dioxide absorption on potassium borohydride. 13 figures.

32294 **Preparative liquid chromatography for fractionation of petroleum and synthetic crude oils.** Vogh, J.W.; Thomson, J.S. (Dept. of Energy, Bartlesville, OK). *Analytical Chemistry ;* **53**: No. 9, 1345-1350(Aug 1981).

The procedures for routine preparative liquid chromatographic separation of hydrocarbon classes in high boiling petroleum and coal liquid samples have been improved by use of high-performance liquid chromatography techniques. Separations were carried out on alumina and silica gel to produce sample fractions equivalent to those obtained with older methods. The columns are reusable following suitable solvent backwashing and provide stable performance and good hydrocarbon class resolution over an extended series of runs. The complete operating time, including regeneration to starting conditions, is 80 min for the alumina column and 25 min for the silica gel column. Capacity ranges from 1 to 6 g of sample, depending on its composition.

32295 **Resolution of overlapped electrochemical peaks with the use of the Kalman filter.** Brown, T.F. (Univ. of Washington, Seattle); Brown, S.D. *Analytical Chemistry ;* **53**: No. 9, 1410-1417(Aug 1981).

A major limitation in the use of electrochemical techniques for the quantitative analysis of mixtures is the difficulty of resolving overlapped peaks. This problem is further complicated by the low signal-to-noise ratios often encountered in trace analysis and by the use of electrochemical techniques that produce broad, asymmetric waveforms. This paper demonstrates the use of the Kalman filter for multicomponent analysis of linear sweep voltammograms. Even with the broad, asymmetric linear sweep voltammetry waveform, synthetic data runs show that a peak separation of as little as 2.5 mV is sufficient for peak deconvolution in the presence of random noise. Besides separating overlapped peaks, the method also filters the noise from the signal and can be used to separate the capacitive current component from the Faradaic current component. The method is validated further by using the Cd(II)/In(III) and Cd(II)/In(III)/Pb(II) systems which show peak separations of 40 to 200 mV. The use of the techniques with two other voltammetric waveforms is also demonstrated.

32296 **Condensed phase photoacoustic spectroscopic detection of porphyrins and dyes.** Voigtman, E.; Jurgensen, A.; Winefordner, J. (Univ. of Florida, Gainesville). *Analytical Chemistry ;* **53**: No. 9, 1442-1446(Aug 1981).

A simple piezoelectric detection system suitable for performing highly sensitive liquid-phase photoacoustic spectroscopy is presented. Performance of the system with respect to linearity, solvent effects, and excitation pulse characteristics is experimentally evaluated and compared with theoretical figures of merit. Limits of detection for various porphyrins, laser dyes, and drugs are presented.

32297 **Peak resolution by semiderivative voltammetry.** Toman, J.J.; Brown, S.D. (Lawrence Berkeley Lab., CA). Contract W-7405-ENG-48. *Analytical Chemistry ;* **53**: No. 9, 1497-1504(Aug 1981).

A technique based on semidifferential voltametry has been developed for rapid electrochemical peak resolution. The approach was tested by resolution of synthetic fused peak systems. Subsequently, the approach was applied to semidifferentiated linear scan voltammograms of Cd^{2+}, Pb^{2+}, and In^{3+} and to semidifferentiated linear scan anodic stripping voltammograms of Cd^{2+}, In^{3+}, and Tl^{+}. Resolutions were directly characterized by peak height, potential, and half-width, as well as by the coefficient of determination between experimental and fit peaks. Studies of individual peak systems and of multiple peak systems showed that the method achieved excellent resolution accuracy, failing only as charge transfers became irreversible. Synthetic data were totally resolved with peak separations as small as 25 mV, while real systems were deconvoluted with separations as small as 40 mV. Peak parameters obtained from these resolutions allow observations of electrode processes, even in systems containing overlapped peaks.

32298 Sample introduction and pressure measuring system for chemical ionization mass spectrometers. Illies, A.J. (Univ. of California, Santa Barbara); Bowers, M.T.; Meisels, G.G. Contract AS02-76-ERO-2567. *Analytical Chemistry ;* **53**: No. 9, 1551-1552(Aug 1981).

One of the difficulties with using chemical ionization mass spectrometry (CIMS) in magnetic sector instruments has been that of electrical dischargers through the gaseous sample between the ion source, which may be at potentials at 10kV and ground. A sample introduction method is presented to offset this. It was first used at the University of Nebraska, Lincoln on a modified Atlas CH-4 mass spectrometer operated at ion source potentials up to 3 kV and pressures up to 3 torr. The same technique has been extended at the University of California, Santa Barbara (UCSB), for use with a VG-Micromass ZAB-2F mass spectrometer operated at source potentials as high as 10 kV and pressures up to 1 torr. The basic features of the design are presented. The sample leak valve which is at ground potential feeds into a glass tube which has been packed with approximately 4 in. of glass wool. The end of this glass tube is in contact with the ion source potential. The authors believe that the glass wool may prevent discharging by reducing the positive ion velocities below that required for the emission of secondary electrons and/or providing a very large surface area which may act as the third body in the ion-electron recombination reaction $I^+ + e^- + M \rightarrow I + M$. At UCSB this sample introduction system is used for all gaseous and volatile liquid samples in both EI and CI modes. The only disadvantage with the sample introduction system involves the removal of very polar samples from the glass wool. However, overnight pumping has removed all samples we have used to date.

32299 Laser-induced fluorescence analysis of vapor-phase pyrene. Whitaker, T.J.; Bushaw, B.A. (Battelle Pacific Northwest Labs., Richland, WA). *Journal of Physical Chemistry ;* **85**: No. 15, 2180-2182(23 Jul 1981).

Collisional quenching of vapor-phase pyrene fluorescence by atmospheric constituents is studied by both quantum yield and lifetime measurements. Oxygen is found to be the only gas studied which shows appreciable quenching characteristics. The rate constant for the bimolecular quenching of pyrene by O_2 is found to be $(1.90 +- 0.08) \times 10^{11}$ L mol-^{1}s-^{1}. In an oxygen-free environment, detection of 1 ppb pyrene is demonstrated by using simple fluorescence techniques. A detection limit of less than 100 parts per trillion is shown to be feasible.

32300 Small angle x-ray scattering: a resurgence and an opportunity. Bragg, R.H. *Journal of the National Technical Association ;* **54**: No. 3, 86-89(Sum 1980).

Small angle x-ray scattering, used to study microscopic levels of structures in matter since 1939, until recently suffered from the serious problems of low intensity sources and the necessity of using slit collimation geometry and point-by-point intensity measurements. The siuation has changed since 1973 with the development of more powerful sources and both one-and two-dimensional position sensitive x-ray detectors which enables simultaneous recording of many data points. Data free of slit distortion can now be obtained at a rate approximately 100 times faster than previously at the newly founded user-dedicated National Center for Small Angle Scattering Research at Oak Ridge, Tennessee. Opportunities for significant research in chemistry, solid state physics, biology and metallurgy/materials science are now available to investigators plagued with small budgets and limited facilities for scattering experiments.

32301 Influence of diffracting conditions on quantitative electron energy loss spectroscopy. Zaluzec, N.J. (Argonne National Lab., IL); Hren, J.; Carpenter, R.W. Contract EY-76-C-05-0033. pp 114-115 of Thirty-eighth annual proceedings of the Electron Microscopy Society of America. Bailey, G.W. (ed.). San Francisco, CA; Electron Microscopy Society of America (1980).

The influence of diffracting conditions on electron energy loss spectroscopy (EELS) was determined by measuring the relative intensity ratio I/sub K//sup A/(β,δ)/I/sub O/(β,Δ) as a function of the deviation parameter s, where the first term is the intensity of electrons which have excited the K/sup th/ inner shell level and the second term is the total transmitted intensity measured over an energy window Δ and an acceptance angle β. Measurements were done on an electropolished single crystal specimen of V. The results of the experiment were in good quantitative agreement with similar experiments performed on the C K-edge in graphite and the N K-edge in AlN. The pronounced oscillations in the partial ionization cross section for /s/>0 in the AlN work were not observed in this work. It is concluded that the errors in quantitative EELS are minimized at values of /s/>>O using non-zero incident beam divergence and at specimen thicknesses t is not equal to ϵ/sub g//2. These errors are seen as being most significant during absolute quantification, and an equation is proposed to reduce the errors. (BLM)

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 32247, 32319

32302 (AD-A—089387) Solvent isotope effects upon the kinetics of some simple electrode reactions. Technical report. Weaver, M.J.; Tyma, P.D.; Nettles, S.M. (Michigan State Univ., East Lansing (USA). Dept. of Chemistry). 15 Aug 1980. Contract N00014-79-C-0670. 40p. NTIS, PC A03/MF A01.

The effect of replacing H2O with D2O solvent upon the electrochemical kinetics of simple transition-metal redox couples containing aquo, ammine, or ethylenediamine ligands have been investigated at mercury electrodes as a means of exploring the possible contribution of ligand-aqueous solvent interactions to the activation barrier to outer-sphere electron transfer. Comparison of isotope rate ratios for corresponding electrochemical and homogeneous outer-sphere reactions involving cationic ammine and aquo complexes yields values of isotopic rate ratios of hydrogen and deuterium for the former processes that are typically markedly larger than those predicted by the Marcus model from the homogeneous rate ratios. These discrepancies appear to arise from differences in the solvent environments in the transition states for electrochemical and homogeneous reactions.

32303 (BNL—29364) Separation of hydrogen isotopes via single column pressure swing adsorption. Wong, Y.W.; Hill, F.B. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-811007—2). NTIS, PC A02/MF A01. Order Number DE81015658.

From 2. world congress of chemical engineering; Montreal, Canada (4 Oct 1981).

Separation of hydrogen isotopes based on kinetic isotope effects was studied. The mixture separated was hydrogen containing a trace of tritium as HT and the hydride was vanadium monohydride. The separation was achieved using the single-column pressure swing process. Stage separation factors are larger and product cuts smaller than for a two-column pressure swing process operated in the same monohydride phase.

32304 (BNL—29580) Dissolution kinetics during localized corrosion. Isaacs, H.S.; Newman, R.C. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 12p. (CONF-811013—2). NTIS, PC A02/MF A01. Order Number DE81025092.

From Electrochemical Society conference; Denver, CO, USA (11 Oct 1981).

The dissolution kinetics of iron and cobalt have been measured under one-dimensional diffusional boundary conditions. Experimental results obtained in aggressive neutral electrolytes show features resulting from transient supersaturation, salt film precipitation and diffusion controlled dissolution. A mathematical model incorporating these features has been applied to metal dissolution in neutral chloride solutions. The effects of sulfur-containing ions on localized dissolution of iron are descirbed with reference to the stress-corrosion cracking of sensitized stainless steels. 12 figures.

32305 (BNL—29895) Electron transfer in weakly interacting systems. Sutin, N.; Brunschwig, B.S. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 33p. (CONF-8106139—3). NTIS, PC A03/MF A01. Order Number DE81026134.

From Symposium on inorganic reaction mechanisms; Detroit, MI, USA (10 Jun 1981).

A recently proposed semiclassical model, in which an electronic transmission coefficient and a nuclear tunneling factor are introduced as corrections to the classical activated-complex expression, is described. The nuclear tunneling corrections are shown to be important only at low temperatures or when the electron transfer is very exothermic. By contrast, corrections for nonadiabaticity may be significant for most outer-sphere reactions of metal complexes. The rate constants for the $Fe(H_2O)_6^{2+}$-$Fe(H_2O)_6^{3+}$, $Ru(NH_3)_6^{2+}$-$Ru(NH_3)_6^{3+}$ and $Ru(bpy)_3^{2+}$-$Ru(bpy)_3^{3+}$ electron exchange reactions predicted by the semiclassical model are in very good agreement with the observed values. The implications of the model for optically-induced electron transfer in mixed-valence systems are noted.

32306 **(DOE/ER/10831—1) Depopulation rates for combustion-related species in long-lived vibrationally or electronicaly excited levels. Technical progress report, 15 January-15 July 1981.** (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemistry). 1981. Contract AC02-81ER10831. 9p. NTIS, PC A02/MF A01. Order Number DE81030042.

This report consists of three sections, the first two dealing with new measures of molecular properties and the last with techniques and instrumentation.

32307 **(INIS-mf—6120) Chemistry and technology of neorganic sorbents. Interinstitute collection of preceedings.** (Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow; AN SSSR, Moscow. Nauchnyj Sovet po Neorganicheskoj Khimii). 1979. 20p. (In Russian). NTIS, PC A02/MF A01.

Selected papers are indexed separately.

32308 **(LBL—11891) Oxygen reduction with carbon supported metallic cluster catalysts in alkaline electrolyte.** Ross, P.N. Jr. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 16p. (CONF-8105105—4). NTIS, PC A02/MF A01. Order Number DE81027400.

From Symposium on electrocatalyis; Minneapolis, MN, USA (10 May 1981).

The atomic structure of clusters of Pt group metals dispersed on carbon blacks was examined using transmission electron microscopy and extended x-ray absorption fine structure spectroscopy. Both the catalyzation procedure and the microstructure of the carbon influence the resulting structure of the metal cluster. Colloidal catalyzation of Pt onto a turbostratic carbon black support yields a metallic cluster with an amorphous structure, i.e., no atomic order. The amorphous structure is metastable, undergoing an ordering transition at temperatures above ca. 800 C. The amorphous form of Pt interacts with both oxygen and water more strongly than the crystalline form. This stronger interaction produces characteristically different kinetic behavior of the catalysts for oxygen reduction. These differences take the form of a compensation effects, with lower activation energy and lower pre-exponential factor for the amorphous clusters. The properties of highly dispersed Pt clusters relative to the bulk form appears to be a general feature of the Group VIII metals.

32309 **(LBL—12377) Thermodynamics of electrolyte solutions over the entire miscibility range.** Pitzer, K.S. (Lawrence Berkeley Lab., CA (USA)). Mar 1981. Contract W-7405-ENG-48. 9p. (CONF-811007—1). NTIS, PC A02/MF A01.

From 2. world congress of chemical engineering; Montreal, Canada (4 Oct 1981).

It is shown that the properties of fully ionized aqueous electrolyte systems can be represented by relatively simple equations over wide ranges of composition. There are only a few systems for which data are available over the full range to fused salt. A simple equation commonly used for nonelectrolytes fits the measured vapor pressure of water reasonably well and further refinements are clearly possible. Over the somewhat more limited composition range up to saturation of typical salts such as NaCl, the equations representing thermodynamic properties with a Debye-Hueckel term plus second and third virial coefficients are very successful and these coefficients are known for nearly 300 electrolytes at room temperature. These same equations effectively predict the properties of mixed electrolytes. A stringent test is offered by the calculation of all of the solubility relationships of the system Na-K-Mg-Ca-Cl-SO_4 and the calculated results of Harvie and Weare show excellent agreement with experiment. The more limited data for similar solutions at higher temperatures, up to about 300°C at least, are satisfactorily represented by the virial-coefficient equations.

32310 **(MLM—2856(OP)) Dissolution of surface oxide layers on titanium and titanium subhydride between 25° and 700°C.** Wittberg, T.N.; Wang, P.S. (Mound Facility, Miamisburg, OH (USA); Dayton Univ., OH (USA). Research Inst.). 1981. Contract AC04-76DP00053. 18p. (CONF-810926—4). NTIS, PC A02/MF A01. Order Number DE81028044.

From 11. symposium on explosives and pyrotechniques; Philadelphia, PA, USA (15 Sep 1981).

The surface-sensitive, spectroscopic techniques of Auger electron spectroscopy (AES) and x-ray photoelectron spectroscopy (XPS) have been applied to the study of oxide dissolution on titanium and titanium subhydride. In an earlier study it was shown, using AES, that the rate of oxygen dissolution into titanium increased sharply at about 350°C. These data correlated well with physical property measurements that indicated that at these temperatures an exothermic reaction, corresponding to the reaction of free titanium with atmospheric oxygen, was occurring. In the present study the work has been expanded to include studies of TiH/sub x/ (x = 1.15, 1.62). It has been found that dissolution of the native oxide on titanium subhydride occurs at a substantially higher temperature (about 500°C) than for titanium. It appears that the outward diffusion of hydrogen is inhibiting the inward diffusion of oxygen on the subhydride samples at temperatures below 500°C. Further studies of the dissolution of oxides on titanium at fixed temperatures in the range of 300 to 350°C have shown that there is a semi-logarithmic relationship between the surface oxygen level and the time at temperature. This is in agreement with earlier gravimetric studies on titanium oxidation in this temperature range.

32311 **Trapped-electron capture by steroid molecules with two distinct, reactive groups. A test of the long-range tunneling mechanism.** Huddleston, R.K.; Miller, J.R. (Argonne National Lab., IL). *Journal of Physical Chemistry ;* **85**: No. 15, 2292-2298(23 Jul 1981).

A quantitative test of the tunneling mechanism for trapped-electron scavenging in low-temperature glasses is described. Kinetics of reactions of trapped electrons with steroid molecules having two electron accepting groups rigidly held ~ 10 A apart were studied in organic glasses at 77 K. A model for trapped-electron scavenging by such difunctional molecules, based on the long-range tunneling mechanism, is presented. The model predicts that a difunctional molecule can be a considerably less effective electron acceptor than two independent monofunctional molecules when the separation between the two reactive groups is a substantial fraction of the tunneling distances. The experimental results show that the tunneling model does, in fact, quantitatively predict the kinetics for the reaction of e/sub t/$^-$ with difunctional steroids from two pieces of information: (1) the measured kinetics for reaction with monofunctional model compounds and (2) the known distance between the two reactive functional groups. An alternative hopping model might plausibly provide a parametric fit to the data but cannot make a definite prediction. The results provide strong evidence for the long-range tunneling mechanism.

32312 **Decomposition rate constant of fine calcium carbonate powder in a fluidized bed.** Kono, H.O. Chicago, IL; Institute of Gas Technology (1981). 6p. (CONF-810804—14).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Although many papers have been published on the decomposition rate of calcium carbonate (limestone) in the form of large particles, there are very few data available on the decomposition rate of fine limestone particles (smaller than 100μ) under a high heat transfer rate condition as in a fluidized bed. Information of this type would be useful for design of a fluidized bed combustion system or a cement manufacturing process. In this study the decom-

position rate of 48μ to 150μ limestone particles were measured at 1013-1073K by a pulse and response curve technique. A very small amount of limestone powder (0.05 to 0.5 gr) was fed as a pulse into a fluidized bed of Quartz glass particles kept at a specified temperature and fluidized by helium gas. The CO_2 concentration in the gas from the reactor was obtained as a response curve. Decomposition rate constants were obtained by the analysis of this curve. The effects of sample size and sample dispersion on the rate constant are discussed. The effect of parameters such as temperature, particle size, and CO_2 gas concentration on the rate constants was determined. The experimental results show that decomposition rate constants of limestone powder are much higher than those previously estimated in the literature.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 31536, 31560

32313 (CONF-810813—12) Low-temperature hydrogenation of polycyclic aromatic hydrocarbons (PAH's) by tetralin in a molten salt catalyst. Buchanan, A.C. III.; Dworkin, A.S.; Brown, L.L.; Smith, G.P. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE81028061.

From National American Chemical Society summer meeting; New York, NY, USA (23 Aug 1981).

The reaction behavior of phenanthrene, pyrene, anthracene, and naphthacene (tetracene) with tetralin were studied at 80°C in aprotic $SbCl_5$ by in situ ^1H NMR, and by determining the reaction stoichiometry via product analysis following quench and separation procedures. Anthracene and naphthacene were hydrogenated by tetralin in $SbCl_5$, but phenanthrene and pyrene were unreactive. A previous ESR study by the authors showed that phenanthrene and pyrene are not oxidized by $SbCl_5$ to radical cations, but the more easily oxidized anthracene and naphthacene do form radical cations is $SbCl_5$. These results suggest that the unusual low temperature hydrogenation reactions reported here proceed via reaction of the polycyclic aromatic hydrocarbon radical cation with tetralin.

32314 (DOE/ER/02192—1) Electronic relaxation processes in polyatomic molecules. Progress report, September 1980-August 1981. Lim, E.C. (Wayne State Univ., Detroit, MI (USA). Dept. of Chemistry). Sep 1981. Contract AS02-76ER02192. 16p. NTIS, PC A02/MF A01. Order Number DE81030161.

In the past year, our specific aims were to study excited (singlet)-state dynamics of heteraromatic molecules related to proximity effect, spin-sublevel dynamics of the lowest triplet state of diazanaphthalenes and methyl substituted pyrazines, and radiationless transitions in electron donor-acceptor complexes (exciplexes and charge-transfer complexes). In addition to successfully completing several aspects of these objectives, we have carried out picosecond spectral studies of temperature dependence of fluorescence and triplet formation in fluid solutions of acridine, which does not exhibit photophysical properties of molecules with nearby $n\pi^*$ and $\pi\pi^*$ singlet states. The progress on each is discussed.

32315 Electron attachment to molecules. Compton, R.N. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. pp 251-262 of Electronic and atomic collisions. Oda, N.; Takayanagi, K. (eds.). Amsterdam, Netherlands; North-Holland Publishing Company (1980).

Some recent electron-molecule collision studies that are making significant contributions to organic chemistry are mentioned. Recent studies at Oak Ridge National Laboratory on electron attachment to ultracold molecules and molecular clusters are included. Selected data on high Rydberg electron charge exchange with electron attaching molecules is summarized, and the experimental evidence supporting the model of Fermi and Matsuzawa stating the equivalence of Rydberg electrons and slow free electrons is presented. Some of the limitations of the model are also cited. 7 figures, 1 table.

32316 (PB—81-125015) Polynuclear aromatic compounds: synthesis and purification. Final report. Eisenbraun, E.J. (Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry). Dec 1980. 100p. NTIS, PC A05/MF A01.

The synthesis and/or purification of a group of polynuclear aromatic (PNA) compounds commonly found as pollutants in the environment are reviewed and discussed. Details of the experimental procedures and techniques as well as chromatographic and spectroscopic evidence of structure and purity of the compounds supplied to the U.S. Environmental Protection Agency are presented. In addition, the apparatus designed and constructed to meet the synthesis needs together with safety improvements for handling toxic compounds are described. Publications resulting from this work and manuscripts in preparation are cited.

32317 Kinetics of the reactions of hydroxyl radical with benzene and toluene. Tully, F.P.; Ravishankara, A.R.; Thompson, R.L.; Nicovich, J.M.; Shah, R.C.; Kreutter, N.M. (Georgia Inst. of Tech., Atlanta). Contract ER-78-S-05-6030. *Journal of Physical Chemistry ;* **85**: No. 15, 2262-2269(23 Jul 1981).

Absolute rate constants for the reactions of the hydroxyl radical with benzene and toluene were measured within the temperature and pressure ranges $213 \leqq T \leqq 1150$ K and $20 \leqq P \leqq 200$ torr by using He, Ar, and SF_6 as diluent gases. To help elucidate the variations in reaction mechanism with temperature, we also studied OH reactions with deuterated benzene (C_6D_6) and with selectively deuterated toluenes ($C_6H_5CD_3$, $C_6D_5CD_3$, and $C_6D_5CH_3$). Three major reaction channels were characterized kinetically. At $T \leqq 298$ K, electrophilic addition of the OH radical to the aromatic ring is the dominant reactive pathway in all systems studied. At temperatures above 500 K, rapid decomposition of the thermalized adduct back to reactants diminishes the importance of the addition channel and leads to bimolecular reaction rate-constant values significantly lower than those measured near room temperature. At elevated temperatures, the ring hydrogen abstraction (for benzene) and side-chain hydrogen abstraction (for toluene) pathways are shown to be predominant. The measured bimolecular rate constants increase monotonically with increases in temperature above 500 K, and kinetic separation of the two hydrogen abstraction modes for toluene is achieved.

32318 Vibrational energy transfer between $^{12}C^{16}O$ and $^{13}C^{16}O$. Wolk, G.L. (Brookhaven National Lab., Upton, NY); Weston, R.E. Jr.; Flynn, G.W. *Chemical Physics Letters ;* **71**: No. 3, 390-394(1 May 1980).

The rate of the energy exchange process $^{12}C^{16}O(v = 1) + {}^{13}C^{16}O(v = 0) \rightleftharpoons {}^{12}C^{16}O(v = 0) + {}^{13}C^{16}O(v = 1) + 47.2\ cm^{-1}$ has been measured by laser-induced fluorescence; $k_2 = (7.2 +- 0.3) \times 10^4 s^{-1}\ Torr^{-1}$ at 293°K. This result is in reasonable agreement with that predicted by theories based on long-range dipole-dipole interactions. 31 references, 3 figures, 1 table.

4004 Electrochemistry

32319 (LBL—12737) Effects of suspended particles on the rate of mass transfer to a rotating disk electrode. Roha, D.J. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-26. 310p. NTIS, PC A14/MF A01. Order Number DE81028002.

Thesis.

Limiting currents for the reduction of ferric cyanide at a rotating disk were determined in the presence of 0 to 40 percent by volume of spherical glass beads. Experiments were conducted with six different particle diameters, and with rotation speeds in the range of 387 to 270 rpm, usong both a 0.56 cm and a 1.41 cm radius disk electrode. It was established that at a given rpm upon addition of glass beads in the limiting current, i/sub L/, may increase to more than three times its value without solids. This increase in limiting current density is greater at high rotation speeds and with the larger disk electrode. i/sub L/ as a function of particle diameter yields at maximum at $\sim$ 10 μm. Two mass transfer models are offered to explain this behavior, both of which assume that the beads are in contact with the disk electrode and moving parallel to its surface. In the surface renewal model it is assumed that complete mixing takes place with the passage of each bead and the boundary

layer is replaced with fresh bulk solution. While with the particle film model it is assumed the bead and a clinging film of fluid rotate together. The film promotes mass transfer by alternately absorbing and desorbing the diffusing species. The particle film model best explains the observed behavior of the limiting current density. Calculations of stirring power required verses i/sub L/ observed, show that adding beads to increase i/sub L/ consumes less additional power than simply increasing the rotation speed alone and even permits a decrease in the amount of stirring energy required per unit reactant consumed, at limiting current conditions.

4005 Photochemistry

REFER ALSO TO CITATION(S) 32322, 32618

32320 **(DOE/ER/03117—T1) Photochemical reactions of complex molecules in condensed phase. Progress report, November 1, 1980-October 31, 1981.** Linschitz, H. (Brandeis Univ., Waltham, MA (USA)). 15 Jun 1981. Contract AS02-76ER03117. 23p. (COO—3117-19). NTIS, PC A02/MF A01. Order Number DE81027862.

Studied were: photooxidation of porphyrins, photoreduction of aromatic ketones (reduction of triplet benzophenone and triplet 4-carboxy-benzophenone), and photo-isomerization and proton transfer processes in dipyrrylmethenes.

32321 **Photolysis and laser-excited fluorescence and phosphorescence emission of trans-glyoxal in an argon matrix at 13 K.** Diem, M.; MacDonald, B.G.; Lee, E.K.C. (Univ. of California, Irvine). Contract AT-03-76-ER-70217. *Journal of Physical Chemistry ;* **85**: No. 15, 2227-2232(23 Jul 1981).

Matrix-isolated monomers and cage dimers of trans-glyoxal in an argon matrix at 13 K photodecompose to give the same photoproducts, H_2CO and CO, when they are excited in the S_2 reverse arrow S_0 absorption region. The dimers and the monomers in minor sites are photolyzed more easily than the glyoxal monomer in major sites. No photoproducts are formed when they are excited in the S_1 reverse arrow S_0 absorption region, but both fluorescence and phosphorescence emissions are observed with the latter intensity being predominant. Glyoxal A tilde ^{1}A/sub u/ is efficiently quenched to a tilde ^{3}A/sub u/ in an argon matrix, with the matrix playing a role similar to that of collision partners in the gas phase.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 31730, 32442

32322 **(DOE/ER/03106—T1) Radiation chemistry of hydrocarbon and alkyl halide systems. Progress report, August 1, 1980-July 31, 1981.** Hanrahan, R.J. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 1981. Contract AS05-76ER03106. 33p. (ORO—3106-76). NTIS, PC A03/MF A01. Order Number DE81029839.

The results reported here include new measurements on the four systems proposed for study last year. These are pulse radiolysis of alkyl iodide and perfluoroalkyl iodide systems; gamma radiolysis of H_2-CO mixtures; photochemistry and mass spectrometry of propane. The work accomplished is described.

32323 **(PB—81-855272) Radiation curing of polymers. June, 1970-June, 1980 (citations from the Engineering Index Data Base). Report for Jun 70-Jun 80.** Van Put, W. (New England Research Application Center, Storrs, CT (USA)). Jul 1980. 139p. NTIS PC N01/MF N01.

Worldwide reports are cited on research, development, and applications of radiation curing of polymers. Ultraviolet, photoinitiated, vacuum irradiated, and microwave curing or crosslinking of coatings, adhesives and elastomers with physical and mechanical properties are also included. (Contains 121 citations.)

32324 **Separation of traces of isomeric hydroxypyridines in aqueous solution by high-performance liquid chromatography: a comparison of uv absorption versus fluorescence detection.** Selvarajan, N.; Raghavan, N.V. (Notre Dame Univ., IN). *Journal of Chromatography ;* **178**: 355-357(1979).

In order to understand the reactions of hydroxy radical, generated radiolytically, with pyridine, it was necessary to develop a sensitive method for the detection and quantification of isomeric hydroxypyridines. The separation of isomeric dihydroxyphenols on a μBondapak C_{18} column by high-performance liquid chromatography has been reported earlier. Due to extensive use of μBondapak C_{18} columns, this stationary phase was employed for the separation of isomeric hydroxypyridines. The meta- and ortho-hydroxypyridines are strongly fluorescent, whereas para-hydroxypyridine is only weakly fluorescent. The detection of hydroxypyridines was carried out optically by uv absorption at 270 and 250 nm and fluorimetrically by excitation at 305 nm.

4007 Radiochemistry And Nuclear Chemistry

32325 **(DOE/ER/01713—T1) Reaction studies of hot silicon and germanium radicals. Progress report, September 1, 1980-August 31, 1981.** Gaspar, P.P. (Washington Univ., St. Louis, MO (USA). Dept. of Chemistry). 31 Aug 1981. Contract AS02-76ER01713. 19p. (COO—1713-103). NTIS, PC A02/MF A01. Order Number DE81028514.

The experimental approach to attaining the goals of this research program is briefly outlined and the progress made in the last year is reviewed in sections entitled: a. Primary steps in the reaction of recoiling silicon and germanium atoms and the identification of reactive intermediates in the recoil reactions; b. Thermally and photochemically induced silylene and germylene reactions and the reactions of thermally evaporated silicon atoms.

32326 **(ORNL—5596) Transuranium processing plant report of production, status, and plans for the period October 1, 1978-September 30, 1980.** King, L.J.; Bigelow, J.E.; Collins, E.D. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE81028028.

During this period, transuranium elements were obtained from 26 irradiated HFIT targets. The products included 86 mg of ^{249}Bk, 686 mg of ^{252}Cf, 3.1 mg of ^{253}Es, and an estimated 1.4 pg of ^{257}Fm. In addition, about 326 mg of high-purity ^{248}Cm was separated from previously purified ^{252}Cf. One hundred seven product shipments were made from TRU; recipients and the amounts of nuclides shipped are listed in a table. Forty-two standard and two special HFIR targets were fabricated. During the next 18 months, production totals of 110 mg of ^{249}Bk, 1200 mg of ^{252}Cf, 5.5 mg of ^{253}Es, and 2 pg of ^{257}Fm are anticipated. Also, a total of 225 mg of ^{248}Cm is expected to be made available. During this report period, a charcoal adsorber system for radioiodine removal was installed, tested, and placed in service. This system serves as a backup to the Hopcalite-charcoal system for adsorption of ^{131}I from the VOG stream. Seven ^{252}Cf neutron sources were fabricated during this report period. A total of 100 neutron sources have been fabricated previously at TRU. The original and current contents (^{252}Cf and ^{248}Cm) of the existing sources and the individuals to whom the sources are currently loaned are listed in a table. In addition to neutron sources, nine fission sources were prepared by electroplating ^{252}Cf onto platinum disks or foils.Special projects during this report period included (1) purification of two batches of isotopically pure ^{240}Pu, (2) fabrication of two special HFIR targets, (3) repurification of the residues of the einsteinium product from Campaign 56, (4) production of ~ 235 μg of ^{250}Cf by irradiation of ^{249}Bk, (5) radiography of 28 irradiated, stainless steel alloy, fracture-strain specimens, and (6) preparations for the production of 40 μg of ^{245}Es by irradiation of ^{253}Es.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 31774, 32626

32327 **(DOE/PC/30292—3) Synthetic-fuel combustion; pollutant formation. Soot-initiation mechanisms in burning aromatics. Third quarterly report, 1 April 1981-30 June 1981.** Tanzawa, T.; Schertzer, S.P.; Rawlins, W.T. (Physical Sciences, Inc., Woburn, MA (USA)). 1981. Contract AC22-80PC30292. 21p. NTIS, PC A02/MF A01. Order Number DE81029480.

Toluene pyrolysis experiments have been performed using He-Ne laser beam attenuation to monitor soot. The experimental results were consistent with those of previous investigators; however, the laser beam attenuation records showed an anomalously large absorption at the higher temperatures where soot formation should be minimal. This effect could be due to some light-absorbing gas-phase species such as PCAH and/or radicals of PCAH. Diagnostics employed in this report showed ambiguous late-time behavior of the pressure, density, and beam attenuation profiles; clarification of this observation is required.

42 ENGINEERING

4201 General Engineering

32328 **DOE Patents Available for Licensing.** Stuber, C. (ed.). Oak Ridge, TN; Technical Information Center (1981). vp. (PB—81-946800).

Available on a subscription basis at $14.00 per volume (calendar) year.

DOE Patents Available for Licensing (DOE PAL) provides abstracting and indexing coverage of the DOE patent literature, including patent applications, that concerns any apsect of energy production, conservation, and utilization. The citations are arranged by subject category. DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned US patents and patent applications in accordance with the provisions of 10CFR781.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 31587, 31588, 31591, 31592, 31599, 31604, 31611, 31612, 31613, 31692, 31693, 31757, 31938, 31947, 32240, 32404, 32736, 32737, 32772

32329 **(BDX—613-2579) Supplement to operation and maintenance manual Unitek Weld Head No. 2-032-03.** Chandler, L.E. (Bendix Corp., Kansas City, MO (USA)). Apr 1981. Contract AC04-76DP00613. 19p. NTIS, PC A02/MF A01. Order Number DE81029612.

This supplement provides information needed to convert the Unitek Model 2-032-03 mechanical welding head to a Model 2-032-03-01.

32330 **(CONF-810835—6) Test of a cryogenic helium pump.** Lue, J.W.; Miller, J.R.; Walstrom, P.L.; Herz, W. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE81028629.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The design of a cryogenic helium pump for circulating liquid helium in a magnet and the design of a test loop for measuring the pump performance in terms of mass flow vs pump head at various pump speeds are described. A commercial cryogenic helium pump was tested successfully. Despite flaws in the demountable connections, the piston pump itself has performed satisfactorily. A helium pump of this type is suitable for the use of flowing supercritical helium through Internally Cooled Superconductor (ICS) magnets. It has pumped supercritical helium up to 7.5 atm with a pump head up to 2.8 atm. The maximum mass flow rate obtained was about 16 g/s. Performance of the pump was degraded at lower pumping speeds. (LCL)

32331 **(CONF-810835—13) Performance of an internally cooled superconducting solenoid.** Lue, J.W.; Miller, J.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE81028058.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A superconducting magnet constructed of an internally cooled solenoid has been produced and tested. Particular emphasis was placed on measurement of the stability margins of the magnet. Test results showed that this magnet has demonstrated the following merits: (1) it reached short sample critical current limit with no training; (2) no degradation due to strand motion in fields was apparent; (3) it can be charged and discharged to high current densities and high fields at a fast rate; (4) it has reasonable stability margin up to 90% of the critical current; (5) stability measurements verify the scaling relationship for a limiting current below which there is single valued high stability margin; (6) it is not really necessary to have bulk helium flow to ensure high stability; and (7) very high pulse field changes can be accommodated as long as the energy deposition is within its stability margin.

32332 **(K-BD—1053) Seismic evaluation criteria for existing critical industrial facilities.** Manrod, W.E.; Hall, W.J.; Beavers, J.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1981. Contract W-7405-ENG-26. 20p. (CONF-810934—1). NTIS, PC A02/MF A01. Order Number DE81028336.

From Conference on earthquakes and earthquake engineering: the Eastern United States; Knoxville, TN, USA (14 Sep 1981).

Guidelines for the development of seismic evaluation criteria for existing critical industrial facilities are presented. Critical industrial facilities are considered as those facilities that, if damaged by natural phenomena, could result in the release of substances harmful to the public or the environment, or that could result in what owners consider as unacceptable financial losses. The guidelines are intended to assist in developing evaluation criteria for such facilities, which will result in realistic assessments that are representative of the state-of-the-art.

32333 **(LBL—12782) Cryogenic tests of glass-epoxy based electrical insulation.** Taylor, J.D.; Martin, P.S.; Pripstein, M.; Green, M.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 10p. (CONF-810835—11). NTIS, PC A02/MF A01. Order Number DE81028144.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A thin superconducting solenoid for the Time Projection Chamber (TPC) experiment at PEP was constructed at Lawrence Berkeley Laboratory (LBL) in 1979 and tested in 1980. A failure of the ground plane insulation damaged the coil to the point that it required rebuilding. An extensive study of this failure indicated that an iron chip embedded in the bore tube had penetrated the insulation. Before rebuilding the coil, an investigation of the insulation system was done with the goal of determining the most reliable techniques and materials for withstanding high voltages in the coil package. The experience with the TPC coil and its prototypes indicate that glass cloth vacuum-impregnated with epoxy is an excellent material for cryogenic applications from the mechanical standpoint. Further, since the LBL assembly shop had extensive experience with the epoxy formulation used in the coil, there was reluctance to change that component. Therefore, the investigation concentrated on different types of glass cloth and on composites containing glass cloth.

32334 **Stability of internally cooled superconductors. A review.** Dresner, L. (Oak Ridge National Lab., TN (USA)). *Cryogenics ;* **20**: No. 10, 558-563(Oct 1980).

The novel ideas that have evolved during the last five years regarding the stability of internally cooled superconductors are reviewed. Among the topics included are stability-optimized conductors, zero-flow recovery, heating-induced flow, multivalued stability, and the maximum cooling capacity of confined supercritical helium.

32335 **(SAND—78-1744C) Modular asymmetric parachute for wind-tunnel testing.** Klimas, P.C.; Widdows, H.E.; Croll, R.H. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 16p. (CONF-811002—2). NTIS, PC A02/MF A01. Order Number DE81028416.

From 7. AIAA aerodynamic decelerator and balloon technology conference; San Diego, CA, USA (21 Oct 1981).

The construction of a series of asymmetrical wind tunnel model parachutes designed to a modular concept is described. The static force, inflation force, and dynamic force and motion time history wind tunnel testing of up to 123 different configurations is discussed.

32336 **(SAND—81-0187) MADDS Numerical Control Drill Data System (NCDDS) Programmer's Guide.** Pruskowski, J.J. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01. Order Number DE81029284.

A description of the administration, design, algorithms, and computer programming of the NCDDS Numerical Control Drill Data System implemented on a VAX 11/780 computer is presented.

32337 **(SAND—81-0747C) Laboratory evaluation of PDC drill bits under high-speed and high-wear conditions.** Hoover, E.R. (Sandia National Labs., Albuquerque, NM (USA); Society of Petroleum Engineers (AIME), Dallas, TX (USA)). 1981. Contract AC04-76DP00789. 14p. (CONF-811023—4). Society of Petroleum Engineers of AIME, Dallas, TX 75206. Order Number DE81027251.

From 1981 SPE annual technical conference and exhibition; San Antonio, TX, USA (4 Oct 1981).

Recently six experimental polycrystalline diamond compact (PDC) bit designs were tested in the laboratory at 100 and 500 RPM in three different types of rock: Nugget Sandstone, Crab Orchard Sandstone, and Sierra White Granite. This paper describes the testing procedures, summarizes the bits' performance and wear characteristics, and correlates these experimental results with specific design options such as rake angle and bit profile.

32338 **(UCRL—86579) Perspective on precision machining, polishing, and optical requirements.** Sanger, G.M. (Lawrence Livermore National Lab., CA (USA)). 18 Aug 1981. Contract W-7405-ENG-48. 15p. (CONF-810810—22). NTIS, PC A02/MF A01. Order Number DE81028008.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

While precision machining has been applied to the manufacture of optical components for a considerable period, the process has, in general, had its thinking restricted to producing only the accurate shapes required. The purpose of this paper is to show how optical components must be considered from an optical (functional) point of view and that the manufacturing process must be selected on that basis. To fill out this perspective, simplistic examples of how optical components are specified with respect to form and finish are given, a comparison between optical polishing and precision machining is made, and some thoughts on which technique should be selected for a specific application are presented. A short discussion of future trends related to accuracy, materials, and tools is included.

32339 **(Y—2223) Interpolation algorithms for machine tools.** Burleson, R.R. (Oak Ridge Y-12 Plant, TN (USA)). Aug 1981. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE81029463.

There are three types of interpolation algorithms presently used in most numerical control systems: digital differential analyzer, pulse-rate multiplier, and binary-rate multiplier. A method for higher order interpolation is in the experimental stages. The trends point toward the use of high-speed micrprocessors to perform these interpolation algorithms.

32340 **Feasibility of conversion of existing oil and gas pipelines to coal slurry transport systems.** Sandhu, A.S.; Weston, M.D. pp 85-92 of Fifth international technical conference on slurry transportation. Proceedings. Linderman, C.W. (ed.). Washington, DC; Slurry Transport Association (1980).

From 5. international technical conference of slurry transportation; Lake Tahoe, NV, USA (26 Mar 1980).

Since a major component of a coal slurry system is the pipe steel, the conversion of an existing pipeline to coal slurry service effectively utilizes previously invested capital. Thus, the developers of coal slurry pipeline systems now in the conceptual design phase should not exclude the adoption of existing long-distance pipelines from their lists of possible alternatives. Where the existing pipeline is a short distance from the coal mine and where the pipeline terminal is close to the proposed power plant, there may be a real cost benefit to the proposed transportation system to use the existing pipeline. The use of existing facilities also reduces environmental disturbance and limits opposition from competing forms of transportation. This paper discusses the modifications that are required to convert an existing pipeline system to either coal-water slurry or coal-oil slurry service and presents three conversion cases; crude oil pipeline to coal-water slurry serivce, gas pipeline to coal-water slurry service, and crude oil pipeline to coal-oil slurry service. For a specific example, the cost of conversion of each system is compared with the cost of providing a completely new slurry pipeline to transport the coal.

4203 Lasers

REFER ALSO TO CITATION(S) 32372, 32739, 32764

32341 **(AD-A—092599) Potential laser action in He-metal vapor mixtures. Research summary report.** Leventhal, J.J. (Missouri Univ., St. Louis (USA). Dept. of Physics). 1 Nov 1980. Contract N00014-76-C-0760. 2p. NTIS, PC A02/MF A01.

Cross sections for excited state production in ion-molecule collisions have been measured by observing radiation resulting from decay of the excited species. Recent work involving collisions of He++ with Li is discussed.

32342 **(AD-A—092622) Effects of cooperative atomic behavior on lasers. Final technical report.** Senitzky, I.R. (Technion-Israel Inst. of Tech., Haifa). Sep 1980. 29p. NTIS, PC A03/MF A01.

The effect of cooperative behavior, both with respect to pumping and relaxation, on a number of three-level atomic systems - which are assumed to have a dipole moment at all three transition frequencies - is analyzed. The atoms are coupled to two cavity modes resonant at the two intermediate frequencies and pumped coherently at the highest frequency. For sufficiently strong pumping, three steady states are shown to exist, the stability of which depends on the pumping strength and the cavity losses. Transition from one steady state to another produces modulated field pulses in both modes, with the phase of the modulation envelopes as well as the phase of the fields being synchronized. Conditions for the generation of various types of pulses are investigated. A generalization that takes into account pump losses due to atomic reaction is introduced and the effect of these losses is studied.

32343 **(DOE/DP/40071—T1) Low-pressure approach to the formation and study of exciplex systems. Final report.** Sanzone, G. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemistry). Jun 1981. Contract AS02-76DP40071. 59p. (COO—2810-11). NTIS, PC A04/MF A01. Order Number DE81028316.

Under this contract, the following goals were set. (1) Development and construction of an experimental system for the study of the kinetics of excimers, and demonstrate the validity of the low-pressure approach to such studies. The apparatus was to consist of the following: (a) cluster-molecular-beam source of van der Waals dimers and higher oligomers; (b) modulated-beam mass spectrometer; (c) low-energy electron beam for the production of excimers; (d) vacuum-ultraviolet to Visible detection and photon-counting system to monitor excimer emission; (e) flash-excited tunable laser for studies of resonant self-absorptions. (2) Form Ar_2 in its van der Waals ground state. (3) Produce Ar_2* by electron bombardment of Ar_2. (4) Perform fluorescence and photon absorption studies of Ar_2*. At the end of the contract period, goals 1 and 2 have been met; experiments 3 and 4 have been designed.

32344 (DOE/DP/40113—1) Conceptual design of an angular multiplexed rare-gas-halide laser-fusion driver. Final technical report, 1 August 1979-31 May 1980. Parks, J.H. (Avco-Everett Research Lab., Everett, MA (USA)). Nov 1980. Contract AC08-79DP40113. 338p. NTIS, PC A17/MF A01. Order Number DE81029900.

A conceptual definition for angular multiplexed rare gas halide drivers was formulated and several design examples analyzed. Angular multiplexed rare gas-halide lasers, in particular the KrF* laser, can be designed to meet ICF requirements. These lasers are scalable, emit at short wavelengths (KrF* 250 nm), and through the use of optical angular multiplexing, produce the required high energy (~ 1 to 5 MJ) in a short pulse (~ 10 nsec) with projected overall efficiency in the range of 5 to 7%.

32345 (LA-UR—81-2348) Stimulated Raman scattering and four-wave mixing in CO_2-pumped para-H_2. Carlsten, J.L.; Kurnit, N.A. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 36p. (CONF-810844—1). NTIS, PC A03/MF A01. Order Number DE81028730.

From Gordon conference on nonlinear optics and lasers; Wolfesboro, NH, USA (3 Aug 1981).

The Stokes source and CO_2 are combined with orthogonal polarization on a Ge beamsplitter and rendered oppositely circularly polarized by a KBr Fresnel rhomb, and then co-propagated through the amplifying medium contained in a 3m LN_2-cooled alumina waveguide. With this system, gain as high as e^9 on the peak of mode-locked spikes was observed, and with an HF OPO as input source, the system could be driven into pump depletion, but only for well-mode-locked pulses. Work with multipass refocusing cells is described both with a room temperature multipass cell (MPC) and also with a LN_2-cooled MPC. In addition to the gain measurements with the diode, we have obtained fully-depleted pump pulses with an OPO input, and have observed two-frequency depletion using two-pump pulses and one Stokes input, which is initiated by four-wave mixing. We have also obtained pump depletion starting from noise with a strong 9-μm pump. The process involved is stimulated rotational Raman scattering in para-H_2. Scattering occurs from the J = 0 to the J = 2 rotational state which gives a Raman shift of 354.36 cm^{-1}. By using para-H_2, from the blowoff of LH_2, one eliminates the odd rotational levels and thereby increase the gain for the J = 0 to J = 2 Raman transition. Results are presented and discussed. (WHK)

32346 (UCRL—85665) Compact 36 kJ electron beam system for laser pumping. Schlitt, L.G. (Lawrence Livermore National Lab., CA (USA)). 31 May 1981. Contract W-7405-ENG-48. 16p. (CONF-810659—22). NTIS, PC A02/MF A01. Order Number DE81024375.

From 3. IEEE international pulsed power conference; Albuquerque, NM, USA (1 Jun 1981).

An electron beam machine consisting of six modules is being constructed for the 'B' amplifier of the RAPIER KrF laser system. Each module consists of a diode, a 5 Ω positive charged water dielectric Blumlein pulse-forming line, and a five stage Marx generator. Separate 25 cm x 41 cm electron beams are formed in magnetically isolated diodes which when arranged in groups of three produce two nearly continuous 25 cm x 125 cm beams that enter the laser cell from opposite sides. The pulse-forming lines operate at 450 keV and produce 150 ns long pulses. The lines employ electrically triggered annular SF_6 output switches. The two concentric transmission lines of each pulse-forming line are charged in 1 μs through symmetric circuits to reduce diode prepulse voltage. The six modules together with the laser cell will occupy less than 15 m^2 of floor space.

32347 (UCRL—86568) Nonadiabatic corrections and detrapping for variable parameter free electron lasers. Garrison, J.C.; Wong, J. (Lawrence Livermore National Lab., CA (USA)). 10 Aug 1981. Contract W-7405-ENG-48. 18p. (CONF-8106145—1). NTIS, PC A02/MF A01. Order Number DE81028425.

From 1981 workshop on free electron lasers; Sun Valley, ID, USA (22 Jun 1981).

In analytical treatments of free electron laser (FEL) problems it is very convenient to use an adiabatic approximation in which the electron orbits are calculated as though the wiggler and signal fields were constant. The slow spatial variations of the field amplitudes are then reinstated at the end of the calculation. A check to see if secular effects are present in the corrections to the adiabatic approximation for FEL problems is described. It is shown that the non-static action-angle transformation produces a new Hamiltonian in which the non-adiabatic effects are explicitly given by the term g kappa. Perturbation expansions in g are valid in the interior of the trapping region with the exception of an exponentially small neighborhood of the separatrix. By using Lie transform perturbation theory it was found that secular effects are absent to O(g), and also showed that the $O(g^2)$ secular effects are not important in the FEL application. The non-secular, non-adiabatic corrections are small and easily included in the Maxwell-Liouville equations. The arguments justifying the use of perturbation theory for trapped electrons were also applied to derive an approximate treatment of the detrapping problem. In addition to the geometrical detrapping caused by the slow variation of the separatrix, a dynamical term associated with non-adiabatic distortions in the electron orbits was found. In general these two terms are of the same order-of-magnitude. (WHK)

4204 Heat Transfer And Fluid Flow

32348 (CONF-810842—2) Note on a further generalization of the Ehrenfest URN model. Uppuluri, V.R.R.; Wright, T. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE81028566.

From American Statistical Association meeting; Detroit, MI, USA (10 Aug 1981).

The Ehrenfest Urn Model (P. and T. Ehrenfest (1907)) has had application to heat exchange problems between two isolated bodies. The basic model can be described as an urn containing w_0 white and b_0 black balls. A ball is drawn at random from the urn and is replaced by a ball of opposite color. The interest is in the distribution of W/sub n/, the number of white balls in the urn after n drawings with replacement. A number of modifications and generalizations of the model are knwon. A further generalization of the model is given which permits replacement by a ball of either color with randomization before each replacement.

32349 (LBL—12009-Rev.) Generalized algebraic relation for predicting developing curved channel flow with a k-ϵ model of turbulence. Humphrey, J.A.C.; Pourahmadi, F. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 16p. (CONF-810927—1(Rev.)). NTIS, PC A02/MF A01. Order Number DE81028131.

From 3. symposium on turbulent shear flow; Davis, CA, USA (9 Sep 1981).

Using algebraic approximations for the Reynolds stress equations a general expression has been derived for C/sub μ/ in ν/sub t/ = C/sub μ/ k^2/ϵ which accounts simultaneously for the effects of streamline curvature and pressure-strain in the flow, including wall-induced influences on the velocity fluctuations. The expression derived can be shown to encompass smilar but more specific formulations proposed by Bradshaw, Rodi, and Leschziner and Rodi. The present formulation has been used in conjunction with a k-ϵ model of turbulence to predict developing, two-dimensional, curved channel flows where both curvature and pressure-strain effects can be large. Minor modifications to include the influence of curvature on the length scale of the flow near the walls produce a significant improvement in the calculations. While, in general, predictions are in good agreement with experimental measurements of mildly and strongly curved flows, the model tends to overpredict the kinetic energy of turbulence in the inner-radius (convex) wall region. This is attributed to a breakdown of the assumption that u/sub i/u/sub j//k is a constant in the derivation of the general expression for C/sub μ/. Most of the experimental results suggest the presence of a weak cross-stream motion due to Taylor-Goertler vortices which cannot be resolved by the calculation scheme. Despite its limitations the present formulation provides a degree of generality not previously available in two-equation modeling of turbulent flows.

4205 Materials Testing

REFER ALSO TO CITATION(S) 31650

32350 (KAPL—4129) Ultrasonic inspection of full-size bolting specimens. Wagner, T.A.; Anderson, P.; Gavin, D.A. (General Electric Co., Schenectady, NY (USA)). Nov 1980. Contract AC12-76SN00052. 20p. (CONF-811003—1). NTIS, PC A02/MF A01.

From ASNT fall conference; Atlanta, GA, USA (12 Oct 1981).

The development and use of an automatic ultrasonic inspection procedure for bolts with heater bores are described. Application of the procedure to accelerated lifetime studies of full-size bolting specimens is explained. Inspection results and conclusions are given.

32351 (PNL-SA—9499) Eddy-current phasography. Collins, H.D.; Davis, T.J.; Busse, L.J.; Gribble, R.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 19p. (CONF-810470—2). NTIS, PC A02/MF A01. Order Number DE81024242.

From 13. symposium on nondestructive evaluation; San Antonio, TX, USA (21 Apr 1981).

A new concept, phasography, has been developed showing excellent potential for high resolution imaging of flaws using eddy current data. The process may be thought of as an eddy current equivalent to acoustic holography. Phase multiplication of the detected coherent signal is used to simulate a test wavelength one to two orders of magnitude smaller than the actual wavelength, permitting the use of image reconstruction techniques. Since this process is performed on the detected data, the eddy current penetration depth remains unchanged. It is also possible to apply this phase multiplication technique to low frequency acoustic holography, resulting in a test which combines excellent penetration of difficult materials with high resolution images. Preliminary experimental results graphically illustrate this unique imaging technique. Eddy current phasograms and their reconstructed images of small internal simulated defects in 1 mm thick stainless steel plates are presented in this paper.

4206 Safety Engineering

32352 (PB—81-123069) Seismic stability evaluation of earth structures. Final report. Singh, M.P.; Ghafory-Ashtiany, M. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Engineering Science and Mechanics). Nov 1980. 135p. NTIS, PC A07/MF A01.

An analytical approach is proposed for seismic design evaluation of earth structures like foundations and slopes. The approach is based on random vibration principles. Seismic design inputs defined in terms of response spectra curves can be directly used. For verification of the proposed approach a comparative study of the results obtained by a rigorous nonlinear analysis approach and the proposed approach is conducted. It is observed that the proposed approach will provide a safe and conservative evaluation of an earth structure design for earthquake induced ground motions.

4208 Electronic Circuits And Devices

32353 (SAND—81-0744C) Modeling and scaling experiments of explosive driven pulse power systems. Tucker, T.J.; Turman, B.N. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 3p. (CONF-810659—29). NTIS, PC A02/MF A01. Order Number DE81028212.

From 3. IEEE international pulsed power conference; Albuquerque, NM, USA (1 Jun 1981).

The utilization of chemical high explosives for the production of large electrical pulsed currents has long been an attractive possibility. This follows from their relatively high energy density, of the order of 5 kJ/g, and their rapid energy release rates. At megamp levels one of the most promising methods of energy conversion is provided by the magnetocumulative generator, i.e., MCG. Although the generation of large pulse currents has been extensively studied, the output current profiles generally obtained were often far too slow for many pulse power applications. Typical MCG outputs are exponential in character with time constants of a few 10's of microseconds. Since their risetime is primarily limited by the explosive detonation velocity pulse shaping must be achieved electrically in the generator output circuitry. This report summarizes work on pulse shaping using an explosively operated opening switch (EOS) in the output circuit, and is presented in two major sections. First, the EOS switch requirements are determined in a modeling study of a proposed MCG system driving both the switch and a parallel load. Second, an experimental program to develop the EOS switch is reviewed.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 31529, 31585, 31615, 31794, 31925, 31934, 32184

32354 (DOE/ET/15460—T1) Operation and testing of the Wormser Grate fluidized-bed combustor at the USM Corporation facility at Beverly, Massachusetts. Final report, April 15, 1980-April 14, 1981. Fraser, R.G. (Wormser Engineering, Inc., Middleton, MA (USA)). May 1981. Contract AC21-80ET15460. 215p. NTIS, PC A10/MF A01. Order Number DE81027955.

The Wormser Grate is a two-stage, fluidized-bed combustor designed to retrofit industrial boilers to burn coal in an environmentally acceptable manner. A three million Btu/h. Wormser Grate was retrofitted to an old firetube boiler, and used to provide space heating for a United Shoe Corporation Plant in Beverly, Massachusetts. A one year, Deparment of Energy funded program was undertaken to provide valuable experience in operating an F.B.C. in an industrial setting. An instrumentation and data gathering system was assembled, and computer techniques developed to monitor F.B.C. performance. The operability of the unit was proven with 1000 hours of continuous operation, and performance testing indicates that the Wormser Grate exceeds pollution regulations.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 31582

32355 (SAND—80-2667) Approach for estimating soil attachment during penetration events. McNeill, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01. Order Number DE81029431.

It is not presently known if significant soil attachment occurs during a penetration event. If attachment occurs, the penetrator may thereby experience increased decelerating forces and the design loads on the penetrator body may be different from the non-attached case. A method is developed to identify when attachment may occur and to estimate the resulting loads on the penetrator. The important parameters are the weight and dimensions of the penetrator, the velocity of the penetrator, and the stiffness of the soil. The method is intended to guide the design of definitive experiments to identify if attachment occurs and to assess the significance of attachment to the design of penetrators.

32356 (SAND—81-0575C) Optimization of bit hydraulic configurations. Glowka, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 39p. (CONF-811023—2). NTIS, PC A03/MF A01. Order Number DE81026953.

From 1981 SPE annual technical conference and exhibition; San Antonio, TX, USA (4 Oct 1981).

Measurements of flow field characteristics across the face of a stud-mounted PDC bit have been obtained in a new test facility which simulates downhole flow fields. this facility and the measurement techniques employed to obtain the data are described. Three hydraulic configurations for the bit have been tested to determine the effects of nozzle location on bottomhole cross-flow velocities and cutter cooling rates. Characteristics of the resulting flow fields

are discussed. The utility of the various measurement techniques in providing data which can be used to optimize hydraulic design is assessed. Ranking of hydraulic configurations as to their abilities to provide cutter cooling is also addressed.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 32409

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 31925

32357 **(DOE/TIC—1028784) Laser-induced fluorescence technique to monitor H_2S (PR 16023). Quarterly technical progress report, May 1, 1981-July 31, 1981.** (Los Alamos National Lab., NM (USA)). 30 Jul 1981. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01. Order Number DE81028784.

The objective of this research project is to develop a means for detecting H_2S at the 0.1-ppM level via laser-induced fluorescence (LIF). Because the upper electronic states of H_2S are repulsive, it is necessary to use a two-laser pump-probe technique. The first laser (ArF, 193 nm) photo-dissociates H_2S into HS and H. Subsequently, a probe dye laser is used to pump the HS ground-state radicals to their $A^2\Sigma^+$ state from which the radicals then fluoresce. This fluorescence signal can be related back to the H_2S concentration prior to dissociation and thus affords a real-time diagnostic for the species of interest. Progress is descirbed.

43 PARTICLE ACCELERATORS

32358 **Cyclotrons--1978.** Martin, J.A. *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-26**: No. 2, 2443-2651(Apr 1979). (CONF-780597—).

From Conference on catalyst deactivation and poisoning; Berkeley, CA, USA (24 May 1978).

A compilation of world's cyclotrons is presented. The information listed includes: name of machine, institution, address, history and status, operation, operation and development staff, research staff, facilities for research, magnet, acceleration system, vacuum system, ion sources/injection system, extraction system, control system, characteristic beams, beam properties, and operating programs. A total of 109 cyclotrons are covered.

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 32751, 32760

32359 **(PB—81-851040) Cyclotrons. January, 1970-October, 1980 (citations from the NTIS Data Base). Report for Jan 70-Oct 80.** Van Put, W. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 206p. NTIS PC N01/MF N01.

The bibliography covers studies, design, testing, and applications of cyclotrons for accelerating protons, deuterons and ions. Studies of cyclotron resonance, emission measurements, and applications to medicine are also included. (Contains 200 citations.)

32360 **(PB—81-851057) Cyclotrons. January, 1976-October, 1980 (citations from the Energy Data Base). Report for Jan 76-Oct 80.** Van Put, W. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 195p. NTIS PC N01/MF N01.

Worldwide information covers studies, design, testing, and applications of cyclotrons for accelerating protons, deuterons and ions. Studies of cyclotron resonance, emission measurements, and applications to medicine are also included. (Contains 200 citations.)

32361 **(PB—81-851065) Cyclotrons. January, 1970-October, 1980 (citations from the Engineering Index Data Base). Report for Jan 70-Oct 80.** Van Put, W. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 199p. NTIS PC N01/MF N01.

Worldwide information covers studies, design, testing, and applications of cyclotrons for accelerating protons, deuterons and ions. Studies of cyclotron resonance, emission measurements, and applications to medicine are also included. (Contains 200 citations.)

32362 **(PB—81-851073) Cyclotrons. January, 1972-October, 1980 (citations from the International Aerospace Abstracts Data Base). Report for Jan 72-Oct 80.** Van Put, W. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 160p. NTIS PC N01/MF N01.

Worldwide information covers studies, design, testing, and applications of cyclotrons for accelerating protons, deuterons and ions. Studies of cyclotron resonance, emission measurements, and applications to medicine are also included. (Contains 200 citations.)

4302 Beam Dynamics, Field Calculations, And Ion Optics

32363 **(FERMILAB-CONF—81/50-EXP) Possible applications of the steering of charged particles by bent single crystals.** Carrigan, R.A. Jr.; Gibson, W.M.; Sun, C.R.; Tsyganov, E.N. (State Univ. of New York, Stony Brook (USA). Dept. of Physics; Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. Contract AC02-76CH03000. 14p. (CONF-810728—5). NTIS, PC A02/MF A01. Order Number DE81028601.

From 9. international conference on atomic collisions in solids; Lyon, France (6 Jul 1981).

This article reviews some aspects of the steering of charged particles using channeling in bent crystals. Crystal angular and spatial acceptance, deflection dechanneling, and radiation damage are discussed. Examples of possible bent transport, focusing, the possibility of charm particle separated beams, and magnetic moment determination.

32364 **(SAND—81-1637) Electromagnetic effects on the formation of potential wells for ion acceleration.** Poukey, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01. Order Number DE81028240.

The new 2-D electromagnetic particle code MAGIC has been used to study the formation of potential wells with relativistic electron beams injected through a foil into a conducting cavity. The basic results are shown to agree with quasi-static work published 5 to 10 years ago.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 32621, 32647

32365 **(BNL—29837) Fast valve for the National Synchrotron Light Source.** Oversluizen, T. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 14p. (CONF-810750—1). NTIS, PC A02/MF A01. Order Number DE81028469.

From 2. national conference on synchrotron radiation instrumentation; Ithaca, NY, USA (15 Jul 1981).

A prototype fast closing, all metal, UHV-compatible valve has been built to protect the NSLS storage rings from sudden vacuum failures which may occur in the experimental beamlines. When triggered, an area of 10 x 140 mm is covered by a spring-driven, guillotine type blade, which forms a high impedance to the inrushing gas. This fast closure assures the protection of the ring vacuum from contamination before the slower UHV valve can be sealed off. Closing times on the order of 3 to 5 msec have been measured. The valve is triggered by a commercial solenoid, powered by a 16,800 μF capacitor bank at 100 volts. Because the valve is situated in a high radiation area, it is remotely resettable.

32366 **(CONF-810835—9) Design study for superconducting main field coils for the Oak Ridge Isochronous Cyclotron.** Schwenterly, S.W.; Litherland, P.S.; Ballou, J.K. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE81028066.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The design study described here demonstrated the feasibility of replacing the existing ORIC coils with superconducting magnets. The design is quite conservative, requires no unusual technology, and should result in a coil system with good reliability and durability. The operating regime of ORIC will be considerably extended, and running costs should be reduced. A proposal to continue with detailed design and coil fabrication is currently under review and has been submitted to the Nuclear Science Advisory Committee.

32367 (LA—8835C, pp 363-377) **NC-6 new experimental techniques and new nuclear chemistry facilities. Summary report and recommendations from panel.** Hudis, J. (Brookhaven National Lab., Upton, NY); Vieira, D.J. May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Panel NC-6 was given the charge of reviewing presently available beams and experimental facilities and gathering into one place, to the extent possible, the planned and proposed future accelerator developments and facilities which are of interest to intermediate-energy nuclear chemists. It was also deemed advisable to assimilate the nuclear chemistry community's future experimental needs, many of which became only generally apparent during the course of this Workshop. This report summarizes the highlights of this panel's discussions which, clearly, only briefly touch on the above points.

32368 **(LBL—12685) LBL EBIS Program.** Brown, I.; Feinberg, B. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 18p. (CONF-810579—2). NTIS, PC A02/MF A01. Order Number DE81028124.

From 2. workshop on EBIS and related topics; Saclay, France (12 May 1981).

It has been decided to increase the energy range of the LBL 88-Inch Cyclotron by constructing an advanced ion source for installation on the existing axial injection system. The type of advanced ion source chosen is the Electron Beam Ion Source. The energy range will be increased to 40 MeV/nucleon for the lighter heavy ions and with development to over 20 MeV/nucleon at mass 100. Besides the 88-inch Cyclotron, present accelerators at LBL include the SuperHILAC, with beam energy up to 8.5 MeV/A, and the Bevalac, which will provide beams from 40 MeV/A to 2 GeV/A at all masses upon completion of the current Uranium Beams line item. Initial ion source design and design of the test bench are described.

32369 **(SAND—81-0778C) Combinaion of PBFA I lines in a disk feed.** Crow, J.T.; Peterson, G.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 6p. (CONF-810659—30). NTIS, PC A02/MF A01. Order Number DE81028213.

From 3. IEEE international pulsed power conference; Albuquerque, NM, USA (1 Jun 1981).

Sandia National Laboratories Particles Beam Accelerator PBFA I has 36 radially converging magnetically self-insulated triplate transmission lines. Each of these magnetically insulated transmission lines (MITL's) has a tapered section at the output which changes the configuration from triplate to coaxial. Some ion diodes proposed for testing on PBFA I are cylindrically symmetric about the machine center and require the combination of the individual PBFA I lines a triplate disk feed. The combination of many MITL's presents two potential problems. There is the possibility that an early pulse from one line might reflect into nearby lines destroying the magnetic insulation in these lines. A computer simulation of a two-line combination showed serious losses, but the line coupling in this 2-D simulation was significantly different. Another possibility is loss of energy in the regions of zero magnetic field between individual lines at the beginning of the disk feed. An experiment on PBFA I is reported which combined two MITL's into a sector of a disk which showed current losses of 12% or less in the later line for pulse arrival time differences of zero to 200 ns, and no evidence of significant losses in the regions of low magnetic filed.

32370 **(SLAC-PUB—2742) SLAC CAMAC crate controller CCU2 with auxiliary controller bus interface.** Walz, H.; Olsen, J. (Stanford Linear Accelerator Center, CA (USA)). May 1981. Contract AC03-76SF00515. 5p. (CONF-810523—15). NTIS, PC A02/MF A01. Order Number DE81028096.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

The development of a new CAMAC type U controller, compatible with the SLAC parallel branch highway, is described. The controller also provides an interface for the Standard Auxiliary Controller Bus, control and timing logic to implement a handshake system between the host computer and the crate controller, an internal timing generator for Dataway cycles, and a LAM handling facility with priority arbitration along the parallel branch highway. A highly integrated module implementation was achieved through extensive use of firmware and finite state logic machine realizations of many crate controller functions.

32371 **(UCRL-tr—1596) Stability of permanent-magnet parameters.** Ilyushchenko, V.I. (Lawrence Berkeley Lab., CA (USA)). 1981. Translation of JINR-R—9-11618, 1978. 6p. NTIS, PC A02/MF A01. Order Number DE81027013.

Data are presented on the time, temperature, and radiation-stability characteristics of permanent magnets composed of barium ferrite, ALNICO alloys, and $SmCo_5$. Magnetic characteristics are constant over a period of 10^4 to 10^5 h. Results are given on reversible and irreversible flux losses. It is concluded that these magnetic materials have a radiation stability similar to that of aluminum and stainless steel.

4304 Storage Rings

32372 **(AD-A—092795) Design study of a free electron laser storage ring.** Wiedmann, H. (Stanford Univ., CA (USA). High-Energy Physics Lab.). Jun 1980. 41p. NTIS, PC A03/MF A01.

The results of a design study for a free electron laser storage ring are discussed. The goal of the study was to show the feasibility of a storage ring beam to be used as the driver for a free electron laser. The requirements for such a storage ring in many respects are more demanding than the parameters of colliding beam storage rings; however, experience and results of many fundamental studies on existing storage rings give us confidence that none of the parameters required for a free electron laser storage ring exceeds the technical possibilities. In fact it was found that the storage ring parameters are well within the state of the art and still leave significant freedom for further optimization. Some of the most characteristic storage ring parameters as obtained in this design study are listed in a table.

32373 **(BNL—29884) National synchrotron light source in the infra-red region.** Williams, G.P. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 14p. (CONF-810750—4). NTIS, PC A02/MF A01. Order Number DE81030037.

From 2. national conference on synchrotron radiation instrumentation; Ithaca, NY, USA (15 Jul 1981).

A discussion of the utilization of the NSLS in the 1 to 100 micron infra-red spectral region is presented. A comparison is made of the respective brightnesses of the NSLS and of black-body sources. The way in which each source may be utilized with a monochromator is discussed and comparative exit slit brightnesses are calculated for selected cases.

32374 **(DOE/ER/10742—1) Development of an x-ray beam line at the NSLS for studies in material science using x-ray absorption spectroscopy. Progress report.** Sayers, D.E. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). 30 Jul 1981. Contract AS05-80ER10742. 9p. NTIS, PC A02/MF A01. Order Number DE81028327.

Development of an x-ray beam-line at the National Synchrotron Light source for the purpose of x-ray spectroscopy (EXAFS) is described. The beam-line layout is shown along with the monochromator geometry. (GHT)

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 31953, 32005, 32074

32375 (DOE/ER/03496—T1, pp 46-79) **Two dimensional position sensitive ΔE-E counter for energetic light charged particles.** Wilcke, W.W. (Univ. of Rochester, NY); Birkelund, J.R.; Kosky, J.P.; Wollersheim, H.J.; Hoover, A.D.; Huizenga, J.R.; Schroeder, W.U.; Tubbs, L.E.; Hilscher, D. Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

A large area position sensitive ΔE-E detector for energetic light charged particles is described. A single wire gas proportional counter is used as the ΔE detector, with stop detectors consisting of three 19 mm thick NE 102 scintillators coupled to RCA 8053 photomultipliers. The total active area of the ΔE-E detector is 43 cm^2. Two dimensional position readout is obtained from the proportional counter by a combination of charge division and electron drift time measurements. The detector is suitable for α particles with energies between 6.5 and 180 MeV. Position resolution is 1 mm in both dimensions, ΔE resolution is 10% and the energy resolution of the scintillators is 3%. The detector is compact enough to fit in a 30″ scattering chamber, where solid angles $\sim > 200$ msr may be attained. An application of this detector in studies of charged particle emission in a heavy ion induced reaction is discussed.

32376 (DOE/ER/10451—2) **Precision positron polarimetry: a new technique in weak-interaction studies. Final report, July 1, 1979-July 1, 1981.** Newman, D.E.; Rich, A. (Michigan Univ., Ann Arbor (USA)). Jun 1981. Contract AS02-79ER10451. 13p. NTIS, PC A02/MF A01. Order Number DE81027435.

The development of a new research instrument, the positron polarization comparator, is described. It consists of a magnetic β-ray spectrometer coupled to a positron polarimeter. This device is capable of comparing the polarization of positrons from two different nuclei to an accuracy which we estimate to ultimately reach 2 x 10^{-4}, thus enabling investigations of weak interaction features previously inaccessible to experiment. The current comparator system, including the results of studies of the systematic effects to be anticipated in such devices, is described.

32377 (LBL—12587) **Small-angle x-ray scattering system with linear position-sensitive detector.** Forouhi, A.R.; Sleaford, B.; Perez-Mendez, V.; de Fontaine, D.; Fodor, J. (Lawrence Berkeley Lab., CA (USA); Spectrolab, Inc., Sylmar, CA (USA)). Apr 1981. Contract W-7405-ENG-48. 11p. (CONF-811012—1). NTIS, PC A02/MF A01. Order Number DE81021920.

From IEEE symposium on nuclear science; San Francisco, CA, USA (21 Oct 1981).

A linear position-sensitive detector has been constructed for use in small-angle x-ray scattering experiments. It is a one dimensional, pressurized gas-filled detector with a delay line read out. Calculated efficiency of the detector at 8.04 keV and 45 psi for Ar-CH_4 filling is 60%, and for Xe-CO_2 filling is 90% limited only by the thickness of the entrance beryllium window. Inherent resolution of the detector is 0.1 mm for normal incident x-rays. The overall resolution of the detection system is determined by the width and angular divergencies of the point collimated CU K/sub α/ beam used in the experiment. The performance of the system is described in terms of measurements on Al-Zn alloy samples.

32378 (RFP—3058) **Portable 1/M meter.** Sheets, W.R. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1 Aug 1981. Contract AC04-76DP03533. 21p. NTIS, PC A02/MF A01. Order Number DE81029000.

A portable 1/M instrument was designed and constructed and used in a number of experiments performed at the Nuclear Safety Facility and provided good data. Its main purpose is to be available in the event 1/M data is needed in a suspected nuclear excursion. The unit was designed around a readily available four function calculator. The main unit including batteries and charger is contaned in a 6-in. x 6-in. x 8-in. cabinet weighing 7 pounds (lb). A second unit contaning the preamp, high voltage power supply and BF_3 counter tube interconnects to the main unit by a coaxial cable. The cable can be several hundred feet long. This unit weighs 2.4 pounds. On command the instrument will store a 100-second background count or a 10-second data count. The 100-second count is averaged to 10-seconds when stored. When the 10-second data count is taken, the instrument reads out a value of 1/M and holds the reading until the next readng occurs. The calculator may also be independently used.

32379 (UH—511-202-75) **Early analysis of neutrino events using the Fermilab 15-foot bubble chamber External Muon Identifier.** Harris, F.A. (Hawaii Univ., Honolulu (USA). Dept. of Physics and Astronomy). Jul 1975. Contract AC03-76ER00511. 14p. NTIS, PC A02/MF A01.

The External Muon Identifier (EMI), which has operated during all neutrino data taking, is aiding in the interpretation of these events. Its purpose is to provide positive information about which of the tracks is a muon in charged-current events and to select neutral-current event candidates. It has also proven extremely useful in eliminating background in the bubble chamber originating from other beamlines by monitoring on-line the counting rate in the EMI chambers.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

32380 (CONF-810316—, pp 93-96) **Solid state microelectronics tolerant to radiation and high temperature.** Draper, B.L.; Palmer, D.W. (Sandia National Labs., Albuquerque, NM). 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

The nuclear and space industries require electronics with higher tolerance to radiation than that currently available. The recently developed 300°C electronics technology based on JFET thick film hybrids was tested up to 10^9 rad gamma (Si) and 10^{15} neutrons/cm^2. Circuits and individual components from this technology all survived this total dose although some devices required 1 hour of annealing at 200 or 300°C to regain functionality. This technology used with real time annealing should function to levels greater than 10^{10} rad gamma and 10^{16} n/cm^2.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 32267, 32289, 32586

32381 (BNL—29850) **Ultra-high-vacuum double-axis goniometer for use with an electron spectrometer.** Shleifer, M.; Williams, G.P. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 8p. (CONF-810750—2). NTIS, PC A02/MF A01. Order Number DE81028470.

From 2. national conference on synchrotron radiation instrumentation; Ithaca, NY, USA (15 Jul 1981).

A double-axis goniometer designed for moving and indexing an electon spectrometer for angle-resolved photoemission studies is described. A feature of the design is that the two rotations operate independently and either can be carried out with the analyzer at any position. The goniometer is designed to be installed in a 14″ spool piece which makes it possible to add it to an existing 14″ uhv system.

32382 (CONF-810316—) **High-temperature electronics. No. 81CH1658-4.** (Arizona Univ., Tucson (USA)). 1981. Contract FG02-81ER10868. 134p. NTIS, PC A07/MF A01. Order Number DE81025058.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

Separate abstracts included for 7 of the papers presented concerning electronic equipment and semiconductor materials. Four papers have previously been input to the data base.

32383 (CONF-810316—, pp 13-15) **High temperature electronic requirements in aeropropulsion systems.** Nieberding, W.C.; Powell, J.A. (National Aeronautics and Space Administration, Cleveland, OH). 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

This paper discusses the needs for high temperature electronic and electro-optic devices as they would be used on aircraft engines in either research and development applications, or operational applications. The conclusion reached is that the temperature at which the devices must be able to function is in the neighborhood of 500° to 600°C either for R and D or for operational applications. In R and D applications the devices must function in this temperature range when in the engine but only for a moderate period of time. On an operational engine, the reliability requirements dictate that the devices be able to be burned-in at temperatures significantly higher than those at which they will function on the engine. The major point made is that semiconductor technology must be pushed well beyond the level at which silicon will be able to function.

32384 (CONF-810316—, pp 21-23) **Passive components for high temperature operation.** Raymond, L.S.; Clark, D.R.; Black, D.O.; Hamilton, D.J.; Kerwin, W.J. (Univ. of Arizona, Tucson). 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

Research and development work at The University of Arizona has been directed toward resistors, capacitors, and interconnect metallizations. The use of Low Pressure Chemical Vapor Deposition (LPCVD) has been used in material development and component fabrication. This is a major departure from a standard thin film deposition method of sputtering and thermal evaporation. LPCVD by its very nature is a process which allows the passive components to be fabricated at temperatures higher than their highest required operating temperature.

32385 (CONF-810316—, pp 101-104) **High-temperature complementary metal oxide semiconductors (CMOS).** McBrayer, J.D. (Sandia National Labs., Albuquerque, NM). 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

The theory on which silicon (Si) metal oxide semiconductors (MOS) technology is founded states that this type semiconductor will perform adequately at 300°C. High temperature tests conducted on commercially available MOS field effect transistors (FET) have confirmed this hypothesis. In this report, the results are presented of an investigation into the possibility of using CMOS technology at Sandia National Laboratories (SNLA) for high temperature electronics. A CMOS test chip (TC) was specifically developed as the test bed. This test chip incorporates CMOS transistors that have no gate protection diodes; these diodes are the major cause of leakage in commercial devices.

32386 (CONF-810810—21) **Evaluation of fiber optics for in-line photometry in hostile environments.** Bauer, M.L.; Bostick, D.A.; Strain, J.E. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE81028139.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

Commercial fiber optics cables, both bundled and single-fiber, were evaluated for application in an in-line photometer being developed for monitoring uranium and plutonium concentrations in high radiation environments in nuclear fuel reprocessing plants. The relative attenuation of the optical signals due to both the radiation damage and to the couplings between lengths of optical cable was determined for specimen cables. An ultraviolet-enhanced fiber bundle demonstrated good radiation resistance to a total dose of 10^8 rads, which is the dose estimated to be received during a 1-y lifetime of the in-cell portion of the photometer. The photometer was designed to use a single-fiber optical cable with adequate radiation shielding.

32387 (LA—8381) **Quadrature flash digitizers and synchronous counters for conversion of analog quadrature signals to phase angle data.** Buchenauer, C.J. (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 22p. NTIS, PC A02/MF A01. Order Number DE81028591.

The methodology and hardware used to deduce and digitally encode the phase angle Phi(t) from quadrature signals of the form $S_1(t) = k(t) \sin Phi(t)$ and $S_2(t) = k(t) \cos Phi(t)$ on an extremely fast time scale are described. Theory and experimental results are given for quadrature flash digitizers and quadrature synchronous counters. Designs for two-stage quadrature digitizers are described. Scaling formulas and design equations are given. These devices appear to be no more complex than conventional linear digitizers and synchronous counters.

32388 (SAND—81-1079) **Recovery of seismic signals in noise by adaptive processing.** Elliott, G.R. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 9p. NTIS, PC A02/MF A01. Order Number DE81029469.

This paper describes techniques for use in improving the signal-to-noise ratio of electrical signals buried in noise from seismic sensors. Often not enough information is available about the characteristics of either the signal or the noise to permit the use of more classical detection methods, i.e., matched filtering, likelihood detectors, array averaging, etc. Adaptive processing can be of benefit in these cases. Examples of Sandia's work in improved performance of perimeter intrusion detection systems is presented.

32389 (SAND—81-1187) **Automated Fresnel lens tester system.** Phipps, G.S. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 71p. NTIS, PC A04/MF A01. Order Number DE81029483.

An automated data collection system controlled by a desktop computer has been developed for testing Fresnel concentrators (lenses) intended for solar energy applications. The system maps the two-dimensional irradiance pattern (image) formed in a plane parallel to the lens, whereas the lens and detector assembly track the sun. A point detector silicon diode (0.5-mm-dia active area) measures the irradiance at each point of an operator-defined rectilinear grid of data positions. Comparison with a second detector measuring solar insolation levels results in solar concentration ratios over the image plane. Summation of image plane energies allows calculation of lens efficiencies for various solar cell sizes. Various graphical plots of concentration ratio data help to visualize energy distribution patterns.

32390 (UCRL—15355-Add.) **Final report on cable-length-measurement system.** (Lawrence Livermore National Lab., CA (USA); Spectrack Systems, Cypress, CA (USA)). 30 Apr 1981. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01. Order Number DE81030015.

The system utilizes the CHIRP technique to measure accurately the static cable length, and the Doppler effect to measure the dynamic rate of change of cable length as it is burned away during tests. Results of this study show that both techniques work well when operated one at a time, but when both CHIRP and Doppler channels are operated simultaneously, interference is produced. (DLC)

32391 (UCRL—85763) **Computer modeling of piezoresistive gauges.** Nutt, G.L.; Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). 7 Aug 1981. Contract W-7405-ENG-48. 12p. (CONF-810931—2). NTIS, PC A02/MF A01. Order Number DE81027964.

From 1. symposium on gages and piezoresistive materials; Archon, France (29 Sep 1981).

A computer model of a piezoresistive gauge subject to shock loading is developed. The time-dependent two-dimensional response of the gauge is calculated. The stress and strain components of the gauge are determined assuming elastic-plastic material properties. The model is compared with experiment for four cases. An ytterbium foil gauge in a PPMA medum subjected to a 0.5 Gp plane

shock wave, where the gauge is presented to the shock with its flat surface both parallel and perpendicular to the front. A similar comparison is made for a manganin foil subjected to a 2.7 Gp shock. The signals are compared also with a calibration equation derived with the gauge and medium properties accounted for but with the assumption that the gauge is in stress equilibrium with the shocked medium.

4404 Well Logging Instrumentation

32392 (CONF-810316—, pp 17-18) **Present an future needs in high temperature electronics for the well logging industry.** Sanders, N.H. (Dresser Industries, Houston, TX). 1981. NTIS, PC A07/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

Deep wells have forced the well logging tool designer to design for reliable operation at high temperature and to put as much circuitry as possible into the small space available. To meet this need the designer must have a wide range of semiconductors, passive electronic components, and dielectric materials commercially available. The key point here is commercial availability such that tools can be designed and then manufactured in sufficient quantities to support the expanding field requirements.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 32401, 32403

32393 **(SAND—81-0052C) Low pressure Hugoniot cusp in polymeric materials.** Sheffield, S.A.; Bloomquist, D.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-810684—46). NTIS, PC A02/MF A01. Order Number DE81028267.

From APS conference on shock waves in condensed matter; Menlo Park, CA, USA (23 Jun 1981).

It has previously been shown that polymethylmethacrylate (PMMA) exhibits a cusp in the shock Hugoniot at about 2.0 GPa which corresponds with the beginning of shock-induced polarization and the beginning of an exothermic reaction measured in thermocouple and resistivity gauge temperature studies. We now report results we have recently obtained from an ongoing study which indicate that other polymers have similar behavior at about the same pressure. Quartz gauge impact experiments have been performed using polypyromellitimide (Vespel) and polysulfone impactors to obtain Hugoniot information and the stress history at the impact plane. In the case of Vespel a slight Hugoniot cusp was observed at about 1.8 GPa which coincides with the start of shock-induced polarization. Polysulfone does not appear to have a cusp but does show stress relaxation at the impact plant beginning at about 1.8 GPa, again coinciding with the start of shock-induced polarization. It has been suggested that the abnormal behavior in PMMA is the result of a shock-induced chemical reaction. This new information suggests that a stress of about 2 GPa is a threshold for shock-induced chemical reaction in several polymers.

32394 **(SAND—81-0487) Low-energy flying-plate detonator.** Jacobson, A.K. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 45p. (CONF-810926—3). NTIS, PC A03/MF A01. Order Number DE81028973.

From 11. symposium on explosives and pyrotechniques; Philadelphia, PA, USA (15 Sep 1981).

A low-energy, hot-wire detonator has been developed in which a flying plate is employed to achieve detonation. A relatively spark insensitive pyrotechnic, titanium subhydride potassium perchlorate, $TiH_{0.65}/KClO_4$, is used as the ignition material. The thermally stable secondary explosive hexanitroazobenzene (HNAB) serves as the donor propellant to accelerate an aluminum flyer. Flyer velocities of 1.3 km/s have been achieved at 10 mm of displacement at -55°C. The detonator will function at -55°C with a 5.0 ampere constant current firing pulse. This paper presents the design criteria and the functional characteristics of the flying plate. A summary of the detonators electrical and environmental characteristics is also presented.

32395 **(SAND—81-0506C) Shock induced hot-spot formation and subsequent decomposition in granular, porous hexanitrostilbene explosive.** Hayes, D.B. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 89p. NTIS, PC A05/MF A01. Order Number DE81029130.

Experimental and theoretical studies on granular, porous hexanitrostilbene (HNS) explosive have yielded an increased understanding of microstructural processes occurring during initiation by shock loading. Experiments involved the planar impact of HNS specimens onto fused-silica targets. Chemical decomposition liberated gaseous products, causing the pressure in the HNS to rise. Velocity interferometry measured material velocity, hence, pressure at the fused silica/HNS interface. An analysis of this pressure excursion yields chemical decomposition history. The data are interpreted in terms of a quantitative two-temperature model which considers hot spots to be formed at pore sites as a result of the irreversible work accompanying the shock. Subsequently, decomposition completion is achieved by burn fronts which propagate radially out from each hot spot at a velocity which can be determined from the bulk decomposition rate. Analysis of the experimental data in the context of the model yields several important results: the delay times corresponding to hot-spot decomposition are shorter than expected; model calculations show about the same inferred hot-spot temperature for different initial porosities and particle sizes in HNS, shock-loaded to equal pressures, which is consistent with experimental results.

32396 **(SAND—81-1773C) Subnanosecond velocity interferometer measurements of detonating PBX-9502.** Sheffield, S.A.; Bloomquist, D.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810602—32). NTIS, PC A02/MF A01. Order Number DE81025476.

From 7. symposium on detonation; Annapolis, MD, USA (19 Jun 1981).

A velocity interferometer system was recently assembled which includes a high speed electronic streak camera to measure the particle velocity-time history of a diffusely reflecting surface. It has been named ORVIS for Optically Recorded Velocity Interferometer System. Measurements were made on detonating PBX-9502 (95/5 mixture of TATB and Kel-F) to determine the structure of the detonation front to see how the results compare with the measurements of Hayes, et al., using electromagnetic gauges embedded in superfine TATB. Measurements were made by reflecting laser light off a copper foil surface and then routing it through a velocity interferometer with a glass etalon in one leg to delay the light by 250 or 500 picoseconds, depending on the setup. The interferometer was tuned such that a pattern of straight fringes was obtained rather than the normal bull's-eye pattern. a cylindrical lens was used to focus each fringe to a dot to concentrate the light. This made the fringe pattern a line of dots which was focused on the slit of an Imacon 790 streak camera capable of streak rates up to 1 mm/ns. With this setup a time resolution of 300 to 500 picoseconds could be attained at the maximum streak rate. These experiments demonstrate that shock-front rise time measurements are now possible to a time resolution of several hundred picoseconds and we feel this approach can be used to attain about 50 picosecond time resolution. It is a powerful method to probe the structure of both shock and detonation waves.

32397 **(UCRL—53160) Model testing of a 10-kg high explosive blast attenuation maze.** Bacigalupi, C.M.; Burton, W.A. (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1981. Contract W-7405-ENG-48. 37p. NTIS, PC A03/MF A01. Order Number DE81029297.

The basement area of the proposed High Explosive Applications Facility (HEAF) at the Lawrence Livermore National Laboratory includes 10-kg HE assembly and process cells, and a 10-kg corridor for the transport of up to 10 kg of HE from the receiving dock to the cells and to the experimental firing tanks. Previous model experiments developed a process cell-maze configuration

that attenuated the effects of an accidental 10-kg detonation to acceptable levels (maximum of 10 to 11 psi reflected). This document reports 1/8-scale model tests conducted to confirm the maze design and to determine the blast pressures in adjacent areas in the final HEAF building configuration. In addition, pressure/time information was obtained at selected points in the model expansion chamber to provide the architect-engineer with information for structural design.

32398 **(UCRL—53180) In-line fuzing development for tactical airfield attack munition (TAAM).** Morrison, J.J. (Lawrence Livermore National Lab., CA (USA)). 18 Mar 1981. Contract W-7405-ENG-48. 5p. NTIS, PC A02/MF A01. Order Number DE81029466.

The shock-hardened new-concept safing, arming, and in-line fuzing system developed for US Air Force modular weapons is being advanced for the Tactical Airfield Attack Munition (TAAM) as an alternate fuzing system. The high power slapper detonator system is being reduced in volume by an approximate factor of 10 and the energy by a factor of 3. In addition, the fuze has the capability of functioning after many hours of delay to provide area-denial capabilities.

32399 **(UCRL—85381) Temperature measurements of shocked translucent materials by time-resolved infrared radiometry.** Von Holle, W.G. (Lawrence Livermore National Lab., CA (USA)). 4 Jun 1981. Contract W-7405-ENG-48. 6p. (CONF-810684—47). NTIS, PC A02/MF A01. Order Number DE81028426.

From APS conference on shock waves in condensed matter; Menlo Park, CA, USA (23 Jun 1981).

Infrared emission in the range 2 to 5.5 μm has been used to measure temperatures in shock-compressed states of nitromethane, cyclohexane and benzene and in polycrystalline KBr. Polymethylmethacrylate shows anomolous emission probably associated with some heterogeneity.

4502 Nuclear

32400 **(AD-A—089188) On-board aircraft damage assessment. Final report, 1 January-1 September 1978.** York, E.N.; Strack, S.L. (Boeing Aerospace Co., Seattle, WA (USA)). 1 Sep 1978. Contract DNA001-78-C-0138. 35p. NTIS, PC A03/MF A01.

The need for crews of strategic aircraft to assess in real time the damage to their aircraft in a nuclear encounter is evaluated. Current on-board sensors are shown to be inadequate and types of sensors are prepared to give on-board damage assessment capability. A plan is proposed to develop and test such sensors.

32401 **(AD-A—092537) Investigation of the computer modeling of the direct coupling of high explosive energy to the ground for surface tangent--above TNT spheres (100-500 tons). Final report 29 May 79-31 Mar 80.** Thomsen, J.M. (Physics International Co., San Leandro, CA (USA)). 7 Apr 1980. Contract DNA001-79-C-0358. 50p. NTIS, PC A03/MF A01.

The calculational modeling of the initial coupling of impulse and energy to the ground for large yield (100-500 tons) surface tangent-above spherical TNT cratering calculations was investigated. A pressure-time surface boundary condition was found to be an accurate way of modeling this initial coupling, if the styrofoam/plywood structure supporting the TNT charge is neglected. The specific boundary conditions used in its current baseline Middle Gust III calculation was examined, and compared favorably with ones previously used. No cratering calculations were found which adequately modeled the TNT charge support structure. One-dimensional calculations were performed to assess its effect on the initial coupling. Results showed that inclusion of a reasonable model for the support structure in a two-dimensional cratering calculation would cause higher close-in peak pressures in the soil, while probably not changing the total directly coupled energy or impulse significantly. Two-dimensional effects would predominate in such a calculation, however, and these were not addressed in the present investigation.

32402 **(AD-A—092543) A decision theory approach to the design of nuclear weapon effect tests. Final report 22 May-30 Oct 78.** Brueske, N.W.; Erickson, R.A. (Boeing Aerospace Co., Seattle, WA (USA)). 10 Nov 1978. Contract DNA001-78-C-0278. 59p. NTIS, PC A04/MF A01.

Utility theory, a part of statistical decision theory, is demonstrated as an experiment design tool by applying it to a rock cavity strength experiment. It determines three optimal experiment configurations. Estimated costs and benefits of these experiments are very near those of the actual experiment in Diablo Hawk.

32403 **(AD-A—092874) Misers Bluff Phase II, ground shock data analysis. Interim report 1 Nov 78-1 Oct 79.** Phillips, J.S.; Melzer, L.S.; Bratton, J.L. (Civil Systems, Inc., Albuquerque, NM (USA)). 31 Oct 1979. Contract DNA001-79-C-0168. 331p. NTIS, PC A15/MF A01.

Phase II of the Misers Bluff high explosive experimental program had as a primary objective, the collection of multiple burst ground motion data in a scaled MX valley, against which the Waveform Synthesis Model (WSM) developed in Phase I could be evaluated. Phenomenology in single and multiple burst environments is examined and its effect on the WSM discussed. The end result of the study is a modified WSM for both single and multiple bursts. Example waveforms from the WSM are compared with Misers Bluff data. Limitations on the WSM are discussed and recommendations for further study are made.

32404 **(UCRL—50016-81-2) Mechanical Engineering Department Technical Review.** Carr, R.B.; Denney, R.M. (eds.). (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1981. Contract W-7405-ENG-48. 111p. NTIS, PC A06/MF A01. Order Number DE81029298.

The Mechanical Engineering Department Technical Review is published to inform readers of various technical activities within the Department, promote exchange of ideas, and give credit to personnel who are achieving the results. The report is presented in two parts: technical achievements and publication abstracts. The first is divided into seven sections, each of which reports on an engineering division and its specific activities related to nuclear tests, nuclear explosives, weapons, energy systems, engineering sciences, magnetic fusion, and materials fabrication.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 32428, 32434

32405 **(DOE/EV/01340—1) Effects of atmospheric variability on energy utilization and conservation. Progress report, 1 January-June 30, 1981.** Reiter, E.R.; Burns, C.C.; Cochrane, H.; Johnson, G.R.; Leong, H.; Sheaffer, J.D. (Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science). Jul 1981. Contract AS02-76EV01340. 99p. NTIS, PC A05/MF A01. Order Number DE81026308.

The grant period 1 January 1981 to 31 December 1981 constitutes the second year of a three-year effort. As in previous years, the research was focused on four major tasks: planetary wave variability and climate fluctuations; regional energy demand modelling; energy demand modelling for air conditioning; and economic factors in climate-sensitive space-conditioning systems design. Efforts in each of these rather broad topic areas are outlined and described in detail. Predicting the impact of climate variability on energy utilization involves understanding both the mechanisms underlying atmospheric variability and the response of energy demand systems to atmospheric variations. Summary descriptions of significant progress in both areas are presented. Studies of planetary wave variability involve both diagnostic and modelling analyses of a broad array of mechanisms linking anomalous regional and global features of the atmospheric circulation. Specific analyses focus on planetary wave anomalies manifest as precipitation surges in the equatorial Pacific, the southern oscillation and the quasi-biennial oscillation. Related studies of the thermal and barrier aspects of the

continents, global teleconnections in anomalous weather patterns and the relationship of recent climate trends to planetary wave activity are also described. Progress is summarized in the development of a quasi-geostrophic model for testing the sensitivity of planetary wave modes to observed perturbations in boundary conditions. Considerable progress was also made in the development and application of our weather dependent models of energy demand for space conditioning. Preliminary results are presented for a regional test application of our community energy demand models.

32406 (LA—8895-MS) Experimental design and data of the August 1980 Corral Gulch nocturnal wind experiment, Piceance Basin, northwestern Colorado. Clements, W.E.; Goff, S.; Archuleta, J.A.; Barr, S. (Los Alamos National Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 200p. NTIS, PC A09/MF A01. Order Number DE81028665.

During August 1980, a meteorological field program was conducted in Corral Gulch in the Piceance Basin of northwestern Colorado. The purpose of this study was to investigate and document the characteristics of the nocturnal drainage and upper level winds. Intensive meteorological measurements were made on four experimental nights using a netv· rk of surface stations, free and captive balloon vertical profilers, an acoustic sounder, and the release and sampling of sulfur hexafluoride (SF_6) tracer. This report is a summary of the experimental design and the data collected during this study, which will be analyzed and interpreted for air quality implications in subsequent articles.

32407 (UCRL—85555) Thermal convection simulation in three dimensions by a modified finite element method. Upson, C.D.; Gresho, P.M.; Sani, R.L.; Chan, S.T.; Lee, R.L. (Lawrence Livermore National Lab., CA (USA)). 21 Jul 1981. Contract W-7405-ENG-48. 24p. (CONF-810935—1). NTIS, PC A02/MF A01. Order Number DE81028847.

From 2. international symposium on numerical methods and heat transfer; College Park, MD, USA (28 Sep 1981).

In the effort to model the advection and dispersion of pollutants in the planetary boundary layer over complex terrain, a relatively simple computer code was developed for solving the three-dimensional Navier-Stokes equations, or variants thereof. The program, which began as an implementation of the Galerkin Finite Element Methoda (GFEM), now incorporates some of the insights and experiences of the finite difference community and has become an eclectic approach to simulating the motion of fluids governed by these equations. In this study, the computer code was applied to the simulation of a Boussinesq fluid contained in a three-dimensional rectangular box which is heated below and cooled above. The temperature difference between these two isothermal surfaces (parameterized by the Rayleigh number, Ra) determines, to a large extent, the complex spatial and temporal thermoconvection patterns. Problems of this sort have received substantial attention recently due to their relevance to natural convection in solar energy collectors, crystal growth in liquids, radioactive waste storage, and more importantly because studying systems of this sort can provide insight into the onset of phase-chaotic-induced turbulence. Presented in the final section are numerical simulations of the two flow configurations observed experimentally, the three and two-roll cell patterns. These results are, to the best of our knowledge, the first calculations of truly time-dependent three-dimensional confined Benard convection at elevated Rayleigh numbers, and they appear to agree well with experiments.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 31564, 31661, 31795, 32217, 32218, 32219, 32513, 32581, 32582

32408 (BNL—29792) Photothermal spectroscopy of aerosols. Campillo, A.J.; Lin, H.B. (Brookhaven National Lab., Upton, NY (USA)). Apr 1981. Contract AC02-76CH00016. 10p. (CONF-8104104—1). NTIS, PC A02/MF A01. Order Number DE81026098.

From SPIE technical symposium; Washington, DC, USA (20 Apr 1981).

In situ aerosol absorption spectroscopy was performed using two novel photothermal detection schemes. The first, based on a photorefractive effect and coherent detection, called phase fluctuation optical heterodyne (PFLOH) spectroscopy, could, depending on the geometry employed, yield particle specific or particle and gas absorption data. Single particles of graphite as small as 1 μm were detected in the particle specific mode. In another geometrical configuration, the total absorption (both gas and particle) of submicron sized aerosols of ammonium sulfate particles in equilibrium with gaseous ammonia and water vapor were measured at varying CO_2 laser frequencies. The specific absorption coefficient for the sulfate ion was measured to be 0.5 m^2/g at 1087 cm^{-1}. The absorption coefficient sensitivity of this scheme was less than or equal to 10^{-8} cm^{-1}. The second scheme is a hybrid visible Mie scattering scheme incorporating photothermal modulation. Particle specific data on ammonium sulfate droplets were obtained. For chemically identical species, the relative absorption spectrum versus laser frequency can be obtained for polydisperse aerosol distributions directly from the data without the need for complex inverse scattering calculations.

32409 (BNL—51397) Engineering evaluation of the use of the Timberline condensing economizer for particulate collection. Butcher, T.; Serry, H. (Brookhaven National Lab., Upton, NY (USA)). Dec 1980. Contract AC02-76CH00016. 20p. NTIS, PC A02/MF A01. Order Number DE81030218.

The possible use of the Timberline Industries condensing economizer as a particulate collection device on commercial sector boilers which are being converted to coal-oil mixture (COM) firing has been considered. The saturation temperature of the water vapor in the flue gas has been estimated as a function of excess air and ambient relative humidity. Also, boiler stack losses have been estimated for a variety of operating conditions including stack temperatures below the dew point. The condensing economizer concept will be limited to applications which can use the low temperature heat including water heating and forced air space heating. The potential particulate collection efficiency, water disposal, and similar heat recovery devices are discussed. A cost analysis is presented which indicates that the economizer system is not competitive with a cyclone but is competitive with a baghouse. The use of the cyclone is limited by collection efficiency. The measurement of COM flyash particle size distribution is recommended.

32410 (DOE/EV/10133—2) Characterization and environmental studies of Pompano Beach anaerobic digestion facility. Semi-annual report. Sengupta, S.; Wong, K.F.V.; Gerrish, H.P.; Nemerow, N.; Daly, E.L. Jr.; Chriswell, C. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering; Ames Lab., IA (USA)). Feb 1981. Contract AS05-78EV10133. 121p. NTIS, PC A06/MF A01. Order Number DE81029840.

This report summarizes the results of routine monitoring of gas quality, airborne particulates, and solid and liquid phases of the Refcom facility at Pompano Beach, Florida. The plant produces methane from municipal wastes by anaerobic digestion. Bacteriological analysis of residual liquids and process streams were performed. Leaching studies with selected soils, filtrates and bottom layer muck were also conducted. A two-dimensional time model was developed. The first appendix contains the results of trace organic analysis of effluents from the facility. The results of environental studies on methane production are presented in the second appendix. The third appendix describes the gas analysis procedure and the gas composition of gas produced at the facility.

32411 (DOE/EV/10404—1) Characterization of carcinogenic species in petroleum-refining localities. Progress report, June 1, 1980-November 30, 1981. Warner, I.M. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). 1981. Contract AS05-80EV10404. 80p. NTIS, PC A05/MF A01. Order Number DE81028339.

The overall objective of this project is to evaluate the identify and concentration of polynuclear aromatic compounds (PNA) that are associated with oil refining localities. To achieve the overall objective, this first phase of research was designed to develop the analytical and air sampling methodologies to be used in the proposed study. Several analytical methods were identified and developed to yield the most information about the PNA content of our samples. These methods include gas and liquid chromatography

(GC and LC), mass spectromety (MS), video fluorometry (VF) and combined techniques such as GC/MS and LC/VF. The air sampling techniques include particulate sampling by high volume air samplers and vapor phase sampling using solid adsorbents. Fractionation of shale oil by liquid chromatography and toxicity studies of the PNA fractions were also performed. Data obtained during the reporting period are presented in this report.

32412 **(DOE/EV/10405—5) Sulfur chemistry in smelter and power plant plumes in the western US.** Eatough, D.J.; Richter, B.E.; Eatough, N.L.; Hansen, L.D. (Brigham Young Univ., Provo, UT (USA)). 30 Oct 1980. Contract AC02-80EV10405. 43p. NTIS, PC A03/MF A01. Order Number DE81029014.

Results are reported for studies of $SO_2(g)$ to particle conversion in the plume of a copper smelter and two coal-fired power plants located in the Great Basin desert region and an oil-fired power plant located on the California coast. Daytime formation H_2SO_4 from $SO_2(g)$ is dominated by a reaction which is first order in $SO_2(g)$ and is temperature dependent, the rate of reaction increasing with increasing temperature. Neutralization of the H_2SO_4 is limited only by the rate of introduction of basic material from ambient air. NH_3 is not the principal base present except on the California coast. Metal oxides and carbonates (e.g., $CaCO_3$) are the predominant bases present in the inland desert areas. Two different classes of aerosol S(IV) compounds are formed from the interaction of $SO_2(g)$ with particulate matter, organic S(IV) species which can hydrolyze to give sulfite and inorganic S(IV) complexes. The inorganic species predominate in smelter plumes while formation of both the inorganic and the organic S(IV) compounds occurs in plumes from combustion of fossil fuels. Formation of the inorganic S(IV) complex is equilibrium controlled and is favored by high $SO_2(g)$ and soluble aerosol Fe and Cu concentrations and by low aerosol acidity. Formation of the organic S(IV) compound follows first order in $SO_2(g)$ reaction kinetics with the rate being inversely proportional to absolute humidity. The relative amounts of sulfate and the two classes of S(IV) compounds are dependent on the ambient temperature and humidity. Formation of the organic S(IV) compound predominates under cold dry conditions while formation of sulfate predominates when the air mass is warm and moist.

32413 **Acidity and conductivity of precipitation on central Long Island, New York in relation to meteorological variables.** Raynor, G.S.; Hayes, J.V. (US Brookhaven Natl Lab, NY). *Water, Air, and Soil Pollution ;* **15**: No. 2, 229-244(Feb 1981).

Three years of hourly sequential precipitation samples collected from central Long Island, N.Y., were anaylzed to determine the concentrations of sulfate, nitrate plus nitrite, nitrogen in ammonium, sodium, and chloride ions. Objectives were to relate changes in precipitation chemistry to causative or associated meteorological factors, determine the mechanisms by which pollutants enter precipitation, and identify the pollutant sources. Acid concentration is highest in the summer, with cold front and squall line precipitation and with rainshowers and thundershowers. It is also high with westerly winds and high temperatures. Seasonal and synoptic conditions are the primary determinants of acid concentration.

32414 **(LBL—12493) X-ray methods for the chemical characterization of atmospheric aerosols.** Jaklevic, J.M.; Thompson, A.C. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 20p. (CONF-810647—10). NTIS, PC A02/MF A01. Order Number DE81028874.

From Conference on X- and gamma-ray sources and applications; Ann Arbor, MI, USA (10 Jun 1981).

The development and use of several x-ray methods for the chemical characterization of atmospherical aerosol particulate samples are described. These methods are based on the emission, absorption, and scattering of x-ray photons with emphasis on the optimization for the non-destructive analysis of dilute specimens. Techniques discussed include photon induced energy dispersive x-ray fluorescence, extended x-ray absorption fine structure spectroscopy using synchrotron radiation and high-rate x-ray powder diffractometry using a position-sensitive gas proportional counter. These x-ray analysis methods were applied to the measurement of the chemical compositions of size-segregated aerosol particulate samples obtained with dichotomous samplers. The advantages of the various methods for use in such measurements are described and results are presented. In many cases, the complementary nature of the analytical information obtained from the various measurements is an important factor in the characterization of the sample. For example, the multiple elemental analyses obtained from x-ray fluorescence can be used as a cross check on the major compounds observed by powder diffraction.

32415 **(PB—81-101974) An experimental study of lake loading by aerosol transport and dry deposition in the southern Lake Michigan basin. Final report, 1 June 1976-31 July 1979.** Sievering, H.; Dave, M.; Dolske, D.A.; Hughes, R.L.; McCoy, P. (Governors State Univ., Park Forest South, IL (USA). Coll. of Environmental and Applied Sciences). Jul 1979. 197p. NTIS, PC A09/MF A01.

A Lake Michigan experimental program to assess the contribution to Great Lakes loading by atmospheric transport and dry deposition of aerosol was conducted. A midlake and nearshore trace element and nutrients data base with associated meteorology capable of establishing a climatology for mass transfer to Lake Michigan was collected during 1977 and 1978. Significant data for Al, Ca, Cu, Fe, Mg, Mn, Pb, Ti, Zn, total P, NO3 and SO4 were obtained. A strong linear dependence upon atmospheric thermal stability in the variability of all twelve aerosol constituents was found, but no linear dependence upon wind speed was found. Bulk deposition velocities as a function of overlake climatology were used to calculate dry deposition atmospheric loadings to Lake Michigan.

32416 **(PB—81-109092) Evaluation and application of SOX measurement procedures for kraft recovery furnaces. Project report July 1976-September 1980.** Jain, A.K.; Blosser, R.O.; Newport, D.B.; Oglesby, H.S. (National Council of the Paper Industry for Air and Stream Improvement, Inc., New York (USA)). Sep 1980. 63p. NTIS, PC A04/MF A01.

The objective of this investigation was to determine the sulfuric acid (SO3/H2SO4) and sulfur dioxide (SO2) emissions from kraft recovery furnaces using an extractive sampling system. The Goksoyr and Ross controlled condensation technique was chosen. Equipment was designed and fabricated to evaluate the effect of coil length, grit porosity, temperature, flow rate, and concentration upon the efficiency of capture of H2SO4 in the modified Grahm condenser. The optimum design and operating conditions to minimize SO3/H2SO4 losses in filter holders used in the sampling train for particulate separation were determined, and the effects of recovery furnace particulate upon SO3/H2SO4 losses were investigated. Sampling of five representative Kraft recovery furnace stack gases showed that the SO3/H2SO4 concentrations varied from 0 to 2.98 ppm, while the range of SO2 concentrations was from 14 to 416 ppm. A comparison of these emissions with the SO3/H2SO4 and SO2 emissions from oil and coal fired utility boilers shows the kraft recovery furnace emissions to be much lower.

32417 **(PB—81-109183) Study of the adequacy of air monitoring. Final report.** Shelar, E. Jr.; Ruff, R.E. (SRI International, Menlo Park, CA (USA)). Sep 1980. 350p. NTIS, PC A15/MF A01.

The study evaluates the adequacy of air quality monitoring data and sampling procedures by assessing the content and implementation of EPA's May, 1979 air monitoring and quality assurance regulations. Interviews were conducted in five areas (Portland, Kansas City, New Orleans-Baton Rouge, Jacksonville, and Boston) with governmental, industry and public interest groups. The overall conclusion was that, given proper personnel and funding, the regulations will provide by 1983, a national monitoring system to satisfy the needs of future air quality planning and status attainment.

32418 **(PB—81-110231) Air quality monitoring. A course manual.** (National Environmental Engineering Research Inst., Nagpur (India)). Jul 1978. 298p. NTIS, PC A13/MF A01.

The Refresher Course on Air Quality Monitoring is being organized for the benefit of engineers and scientists involved in

control programmes. Various aspects such as meteorology, sampling and analytical techniques for particulate and gaseous pollutants, stack sampling, automobile emissions are covered in this Course. A comprehensive coverage of these subjects should prove to be of immense use to participants as well as to others involved in such programmes.

32419 **(PB—81-110926) Industrial process profiles for environmental use: chapter 27 primary lead industry.** (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Jul 1980. Contract EPA-68-03-2577. 83p. NTIS, PC A05/MF A01.

The primary lead industry as defined for this study consists of mining, beneficiation, smelting, and refining. A profile of the industry is given including plant locations, capacities, and various statistics regarding production and consumption of lead, co-products, and by-products. The report summarizes the various commercial routes practiced domestically for lead production in a series of process flow diagrams and detailed process descriptions. Each process description includes available data regarding input materials, operating conditions, energy and utility requirements, waste streams produced (air, water, and solid waste), and control technology practices and problems.

32420 **(PB—81-122996) Comparison of gas phase hydrocarbon emissions from light-duty gasoline vehicles and light-duty vehicles equipped with diesel engines. Technical report.** Carey, P.; Cohen, J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Sep 1980. 31p. NTIS, PC A03/MF A01.

The purpose of this document is to consolidate much of the existing data on gas phase hydrocarbon exhaust emissions from both gasoline vehicles and vehicles equipped with diesel engines. This subject is of interest because new studies have shown diesel emissions to contain compounds of high molecular weight. This high molecular weight component is dominated by particle-bound hydrocarbons; however, the potential health risk associated with heavy hydrocarbons merits examination of the gas phase as well. Particular emphasis will be placed on the comparison of emissions and their potential carcinogenicity. Other areas to be discussed include evaporative hydrocarbon emissions and the effect of fuel composition on gasoline gaseous hydrocarbon emissions.

32421 **(PB—81-800013) Sulfur dioxide control. 1976-July, 1980 (citations from the American Petroleum Institute data base). Report for 1976-July 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 266p. NTIS PC N01/MF N01.

This bibliography contains citations on the different aspects of air pollution control of sulfur dioxide by industry. Covered are control processes, techniques, equipments, design, and performance. (This updated bibliography contains 260 citations, 50 of which are new entries to the previous edition.)

32422 **(PB—81-800161) Nitrogen oxide air pollution: control technology. 1978-August, 1980 (citations from the NTIS data base). Report for 1978-August 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 264p. NTIS PC N01/MF N01.

Nitrogen oxide air pollution control is considered from both mobile and stationary sources. Fluidized bed combustion, boiler combustion modification, and engine design are discussed, as they relate to emissions reduction. (This updated bibliography contains citations, 76 of which are new entries to the previous edition.)

32423 **(PB—81-800179) Nitrogen oxide air pollution: detection and analysis. 1976-August, 1980 (citations from the NTIS data base). Report for 1976-August 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 232p. NTIS PC N01/MF N01.

Techniques and equipment used in the gas analysis of ambient atmospheres, exhaust emissions, and flue gases are cited in the bibliography. (This updated bibliography contains 226 citations, 22 of which are new entries to the previous edition.)

32424 **(PB—81-800187) Nitrogen oxide air pollution: atmospheric chemistry. 1964-1978 (citations from the NTIS data base). Report for 1964-78.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 253p. NTIS PC N01/MF N01.

Research reports on photochemical air pollution models, smog chemistry and reactivity, and SSt exhaust effects are cited in the bibliography. Auroral and upper atmospheric in chemistry, and photochemistry of naturally occurring nitrogen oxides are excluded. (Contains 247 citations)

32425 **(PB—81-800195) Nitrogen oxide air pollution: atmospheric chemistry. 1979-August, 1980 (citations from the NTIS data base). Report for 1979-Aug 80.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 69p. NTIS PC N01/MF N01.

Photochemical air pollution models, smog chemistry and reactivity, and SSt exhaust effects are covered in the bibliography. Auroral and upper atmospheric chemistry, and photochemistry of naturally occurring nitrogen oxides are excluded. (This updated bibliography contains 63 citations, 40 of which are new entries to the previous edition.)

32426 **(PB—81-800211) Nitrogen oxide air pollution: emissions studies. 1978-August, 1980 (citations from the NTIS data base). Report for 1978-August 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Oct 1980. 180p. NTIS PC N01/MF N01.

The bibliography cites studies on emissions from both stationary and mobile sources, emissions factors, regional emission inventories, and general studies. Air quality data is excluded. Nitrogen oxide detection and analysis, industrial control techniques, atmospheric chemistry, and biological effects are covered in Parts 1 through 4. (This updated bibliography contains 174 citations, 62 of which are new entries to the previous edition.)

32427 **(SAND—78-0403/2) Project Da Vinci: a study of long-range air pollution using a balloon-borne Lagrangian measurement platform. Volume 2. Reports of participants in Da Vinci 1. Final report.** Zak, B.D. (ed.). (Sandia National Labs., Albuquerque, NM (USA); AnaChem, Inc., Albuquerque, NM (USA)). May 1981. Contract AC04-76DP00789. 144p. NTIS, PC A07/MF A01. Order Number DE81028186.

Understanding long-range air pollution is becoming increasingly important for the development of cost-effective air-quality control strategies. Project Da Vinci was the beginning of a continuing effort at Sandia to address the need to study long-range air pollution. It consisted of a series of three instrumented, manned balloon flights to study the lower atmosphere in a Lagrangian frame of reference. These experiments gathered information on gases and aerosols, radiation, electrical fields, atmospheric structure, turbulence, diffusion, mesoscale motions, and their interrelationship. Volume II is a collection of the reports from researchers involved in Da Vinci I.

32428 **(UCID—19171) Chlorocarbon emission scenarios: potential impact on stratospheric ozone.** Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01. Order Number DE81023576.

This study is an updated assessment of the potential effect on stratospheric ozone due to past and future chlorocarbon emissions, including an analysis of the changes in total ozone expected for designated chlorocarbon emission scenarios. These assessments are based upon model calculations using a one-dimensional coupled transport and chemical kinetics model of the troposhere and stratosphere.

32429 **(UCRL—85520) Three dimensional, finite elemental model for simulating heavier-than-air gaseous releases over variable terrain.** Lee, R.L.; Gresho, P.M.; Chan, S.T.; Upson, C.D. (Lawrence Livermore National Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 17p. (CONF-810841—1). NTIS, PC A02/MF A01. Order Number DE81028689.

From 12. NATO/CCMS international technical meeting on air pollution modeling and its applications; Menlo Park, CA, USA (25 Aug 1981).

A 3D finite element model was developed to predict the dispersion processes associated with heavier-than-air gaseous releases in the atmosphere. Both 2D and 3D examples were presented to demonstrate the flexibility of the model in simulating the motion of the vapor cloud generated after a liquid natural gas spill over flat or variable terrain. Also presented are results to justify the slightly more complex generalized anelastic model rather than one employing the Boussinesq and/or hydrostatic approximations, which are routinely used for planetary boundary layer flows but can be inappropriate for this application.

32430 **High winter concentrations of SO_2 in the Norwegian Arctic and transport from Eurasia.** Rahn, K.A. (Norwegian Inst. for Air Research, Lillestroem); Joranger, E.; Semb, A.; Conway, T.J. *Nature (London) ;* **287**: 824-826(30 Oct 1980).

Since July 1977, the Norwegian Institute for Air Research has been studying trace gases and aerosols in the atmosphere at Bear Island, an Arctic site located at 74°N and 19°E. Although Bear Island lies well north of the Arctic Circle, the warm Norwegian Sea gives it an annual mean temperature of -1.8°C, considerably warmer than at many other Arctic locations (Barrow, Alaska, for example, is 350 km farther south but has an annual mean of -12.2°C). In summer, Bear Island is surrounded by open water; in winter there is open sea to the south and west and pack ice to the north and east. Atmospheric samples are taken 20 m above mean sea level and 2 m above local ground: high-volume filters are taken three times a week and analyzed for various elements by atomic absorption, neutron activation and wet chemistry; sulfate and sulfur dioxide are measured daily by a method similar to that of Johnson and Atkins, using low-volume (16 m^3) prefilters for sulfate and KOH-impregnated afterfilters for SO_2. The collection efficiency of this method for SO_2 has been tested extensively. Results for the high-volume samples have been reported; here we discuss the SO_2 data, which seem to indicate that during winter there is efficient transport from Eurasian midlatitudes, due at least in part to long atmospheric residence times in and around the Arctic.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 31759, 32053, 32444, 32445, 32448

32431 **(AD-A—092841) A study of stratosphere-to-troposphere transfer using radioactive tracer data in a one-dimensional parameterization. Final report.** Bauer, E. (Institute for Defense Analyses, Arlington, VA (USA)). Feb 1980. Contract DOT-FA77WA-3965. 87p. NTIS, PC A05/MF A01.

This paper reviews radioactive tracer data to determine effective stratosphere-to-troposphere transfer rates for a one-dimensional parameterization. The basic data used are the time-dependent global stratospheric burdens of Zr95 following six Chinese thermonuclear explosions 1967-1976, and also the falloff in burdens of Sr-90 and excess C-14 following the very large Soviet and U.S. test series of 1961-1962. Results of the Chinese explosions demonstrate that transfer of material from stratosphere to troposphere is fast in winter but slow in the summer of initial injection. It is best modeled by a seasonally varying eddy diffusivity profile, showing 'fast' transport (e.g., Dickinson-Chang, Danielsen) for a winter injection, and fast transport delayed to the next winter for a summer injection. Cloud rise height for the 1961-1962 tests is not well known, and so two models for the yield-altitude curve are used: a 'high' (Foley-Ruderman) and a 'low' (Seitz) model. The overall time variation in stratospheric burden of Sr-90 and in stratospheric and tropospheric burdens of C-14 can be simulated best by relatively fast falloff, i.e., by using a low injection height (Seitz) and fast transport (e.g., Dickinson-Chang). The difference in falloff rate of stratospheric burdens of Sr-90 and of C-14 is due principally to the recycling of C-14 (as CO_2) from the troposphere, with minor corrections due to sedimentation of the aerosols carrying Sr-90 and the difference in effective injection height of these two tracers.

32432 **(DOE/DP/00539—044) Interim environmental monitoring report for the Nevada test site, first quarter 1981.** (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring and Support Lab.). Aug 1981. Contract AI08-76DP00539. 24p. (EPA—600/4-81-073). NTIS, PC A02/MF A01. Order Number DE81029955.

During the first calendar quarter of 1981, no radioactivity from the nuclear tests conducted at the Nevada Test Site was measured offsite by the US Environmental Protection Agency's Environmental Monitoring Systems Laboratory. Low concentrations of ^{95}Zr, ^{95}Nb, ^{103}Ru, and ^{141}Ce attributed to the People's Republic of China nuclear test of October 15, 1980, were detected in air samples throughout the Air Surveillance Network. The maximum concentrations of these radionuclides were less than 0.1 percent of the Concentration Guides. The dosimeters of fixed station at Complex I (Coal Valley) indicated an exposure of 1.6 mR, and the dosimeters of two offsite residents, one living at Glendale, Nev., and the other near Complex I, (Coal Valley) appeared to have net exposures of 3.1 mR and 3.2 mR, respectively; however, further evaluation revealed that the net exposures were not due to an exposure from NTS operations, but may be a statistical anomaly related to an unusually low variation in the environmental background exposure rate. Further investigation is in progress.

32433 **(DOE/EV/03944—18) Climatic effects of atmospheric transport and transformation of hydrogenous species. Progress report, July 1, 1980-June 30, 1981.** Oestlund, H.G.; Mason, A.S. (Miami Univ., FL (USA). Rosenstiel School of Marine and Atmospheric Sciences). 1981. Contract AS05-76EV03944. 12p. NTIS, PC A02/MF A01. Order Number DE81028324.

The atmospheric sampling for tritium as HTO and HT has been continued at the stations at Baring Head Lighthouse, New Zealand, and in Fairbanks, Alaska, and Miami, Florida. In addition, tritium bound to hydrocarbons has also been sampled in Miami. All HT sources are in the Northern Hemisphere; when the global burden of tritium in the form of HTO and HT, was estimated, it was found that the variations between Fairbanks, Alaska, and Miami, Florida, were quite erratic and warranted at least one more northern station. A station was therefore established at Oregon State University's Marine Sciences Center, at Newport, Oregon, on the Pacific Ocean. The station was established on January 15, 1981 and is now functioning without problems. Tabulated results from all four stations are presented. The global inventory of tritium gas was about 1.3 kg of tritium in the mid-70s. It has been steadily decreasing, and the present value, June 1981 is approximately 700 g. This development is attributed to virtual cessation of the reprocessing of nuclear fuel elements and possibly better precautions taken by various nuclear installations handling tritium in gaseous form. (JGB)

32434 **(DP-MS—81-20) Status report on DOE-sponsored meteorological model validation program.** Bailey, C.E.; Pepper, D.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 7p. (CONF-811005—1). NTIS, PC A02/MF A01.

From Symposium on intermediate range atmospheric transport processes and technology assessment; Gatlinburg, TN, USA (1 Oct 1981).

The Department of Energy (DOE) is sponsoring a program to evaluate existing and newly developed mesoscale meteorological models. The program is being conducted by the Savannah River Laboratory (SRL), with participation of nine DOE-funded laboratories. The program culminated in a workshop on November 19-21, 1980, at which the participants reviewed calculations made at each of the laboratories. The program was sponsored at this time because of the availablity of extensive ^{85}Kr integrated air concentration measurements and meteorology data obtained in the vicinity of the Savannah River Plant (SRP) during 1975-1977. These data were used for all calculations.

32435 **(GJBX—280-81) Study of the distribution of radon in the atmosphere to a height of 457 meters. Final report.** Clifford, C.E.; Rubin, R.M.; Wells, M.B. (Radiation Research Associates, Inc., Fort Worth, TX (USA)). May 1981. Contract AC13-76GJ01664. 53p. (RRA—T8002). NTIS, PC A04/MF A01. Order Number DE81030293.

An experimental program has been conducted to provide a measurement of the distribution of radon in the atmosphere from ground level to a height of 457 meters above the ground. An extensive set of measurements were obtained using alpha-particle detectors of the Track Etch/sup TM/ type supplied by the Terradex Corporation. These detectors were exposed for periods of approximately three months on four television towers and were read by Terradex. Radon measurements were also made as a function of ground depth. A statistical F-test analysis of the readings from the exposed Track Etch/sup TM/ detectors on the towers leads to the conclusion that the radon concentration in air at each of the tower sites does not vary with height above ground for heights to 457 meters. In order to obtain additional measured data on the altitude variation of the radon concentration in the air, five NaI detectors were incrementally placed in positions ranging from ground level to 457-meters altitude on the Oklahoma City tower. The NaI measurements were evaluated through comparison with calculated predictions of the expected count rate as a function of altitude using ANISN, a discrete-ordinates-transport code. The source distributions in the air and ground and the NaI counter efficiency versus energy were determined analytically. Considering the large uncertainties in the Track Etch/sup TM/ detector data from the 4 television towers and the results of the analysis of the NaI detector measurements on the Oklahoma City tower, it is concluded that the radon concentration in air does not vary significantly with height above ground for heights up to 457 m.

5004 Thermal Effluents Monitoring And Transport

32436 **(PB—81-102493) User's guide for ATCOOL cooling tower plume model. Technical memo.** Hanna, S.R. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Jun 1980. 31p. NTIS, PC A03/MF A01.

ATCOOL is a computer program for calculating the variation of cooling tower plume parameters with height and distance downwind. It combines Briggs' plume rise model with Weinstein's cloud physics model. Plume rise, visible plume length, and cloud formation can be calculated. The program listing and a worked example are given.

5005 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 32448, 32450

5006 Regulations

REFER ALSO TO CITATION(S) 31618, 32467

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 32452

32437 **(DOE/EV/06047—1) Models of carbon flow in tropical ecosystems with emphasis on their role in the global carbon cycle. Final report, September 15, 1978-September 14, 1980.** Brown, S.; Lugo, A.E. (eds.). (Florida Univ., Gainesville (USA). Center for Wetlands). 1980. Contract AS05-78EV06047. 123p. NTIS, PC A06/MF A01. Order Number DE81027999.

The role of tropical forests on the carbon balance of the world is studied with four different approaches: (1) to quantify the area of tropical forests and the changes in forest cover; (2) to calculate the storage and production of organic carbon in tropical forests; (3) the modelling of land use changes in tropical countries using computer simulation models; and (4) the synthesis of information from many sources into conceptual schemes using Life Zone and energy use concepts. Results are not yet conclusive but indicate that tropical forests play a significant role in the global carbon cycle, and they are likely to be small sources of carbon to the atmosphere. The basis for this statement is: (1) the large area of tropical forests do not appear to be changing as fast as suggested earlier; (2) the storage of carbon in the tropics is about one half as previously suggested; (3) the turnover of carbon in the tropics is very fast with large exports to the ocean via rivers; and (4) models of land use change using data from Bolivia show only a small net addition of carbon to the atmosphere.

32438 **Seedling establishment of Ferocactus acanthodes in relation to drought.** Jordan, P.W.; Nobel, P.S. (Univ. of California, Los Angeles). Contract DE-AM03-76-SF00012. *Ecology ;* **62**: No. 4, 901-906(Aug 1981).

The 30 smallest seedlings of Ferocactus acanthodes (Lem.) Britton & Rose (Cactaceae) at a canyon site in the northwestern Sonoran desert averaged 2.5 cm in height. Based on field studies of CO_2 exchange throughout the year, the estimated time of their germination was late summer 1976. To explan why so little establishment occurred in recent years, the length of lethal drought for seedlings of various ages was calculated from the seedling geometry (volume-to-surface ratio), dehydration tolerance, and transpiration rates. Individual years were identified which had sufficiently long growing seasons relative to the length of the subsequent droughts to allow establishment. Eight of the last 18 y were found to be suitable for establishment of F. acanthodes, the latest year being 1976.

32439 **Influences of photosynthetically active radiation on cladode orientation, stem tilting, and height of cacti.** Nobel, P.S. (Univ. of California, Los Angeles). Contract DE-AM03-76-SF00012. *Ecology ;* **62**: No. 4, 982-990(Aug 1981).

Stem orientation and morphology were investigated for 14 species of cacti in Chile, Ecuador, Mexico, and the United States. The interception of photosynthetically active radiation (PAR) was specifically considered for cladodes (flattened stems) of platyopuntias, for tilted cylindrical stems, and in the presence of surrounding vegetation.

32440 **Low temperature phase equilibria in the Fe-Ni and Fe-Ni-P systems: application to the thermal history of metallic phases in meteorites.** Romig, A.D. Jr. (Sandia National Labs., Albuquerque, NM); Goldstein, J.I. Contract AC04-76-DP00789. *Geochimica et Cosmochimica Acta ;* **45**: No. 7, 1187-1197(Jul 1981).

The solubility limits of the α(kamacite) and γ (taenite) phases in the Fe-Ni and Fe-Ni-P phase diagrams have been measured at low temperatures, 700 to 300°C. The predicted $\alpha/\alpha + \gamma$ retrograde solubility below 500°C was demonstrated experimentally for the first time in the Fe-Ni system. The minimum solubility of Ni in γ at the $\gamma/\alpha + \gamma$ boundary increases with decreasing temperature to as much as 54 wt % at 300°C. The addition of P increases the maximum solubility of Ni in α by as much as 1.6 wt % and decreases the minimum solubility of Ni in γ by as much as 7 wt % at 300°C. The solubility limits of kamacite and taenite were also obtained from heat-treated samples of the Grant and Cape York iron meteorites. The data indicate that in iron meteorites minor and trace elements other than P do not significantly shift the Ni solubility limits of the Fe-Ni and Fe-Ni-P phase diagrams. The measured phase diagrams can be used to explain the Agrell effect and the differences in maximum Ni content of taenite among irons and chondrites. The formation of plessite and the influence of the measured solubility limits on the cooling rate simulation method are also considered.

32441 **Hierarchical system for evaluating regional ecological resources.** Klopatek, J.M.; Kitchings, J.T.; Olson, R.J.; Kumar, K.D.; Mann, L.K. (Oak Ridge National Lab., TN). *Biological Conservation ;* **20**: 271-290(1981).

A methodology has been developed to measure the ecological quality of potential wilderness areas under the US Department

of Agriculture (USDA) Forest Service's Roadless Area Review and Evaluation (RARE-II) Program. Four major parameters were chosen to quantify land areas located anywhere in the conterminous United States. These are: (1) vegetation; (2) avian communities and the quality of habitat provided by an area; (3) mammal communities; and (4) endangered or threatened species. The results are shown for the Douglas-fir ecoregion of the United States and are used in a conflict matrix to segregate identified tracts according to their ecological ratings and energy and mineral resource ratings.

32442 **Desert varnish: potential for age dating via uranium-series isotopes.** Knauss, K.G.; Ku, T.L. (Univ. of California, Livermore). Contract W-7405-ENG-48. *Journal of Geology ;* **88**: 95-100(1980).

Trace metals and natural radioisotopes are measured in an unusually thick and presumed ancient desert varnish from the Colorado Plateau in Utah. Uranium and thorium concentrations in the sequence: varnish-altered rind-heartrock (Shinarump formation sandstone) indicate that uranium with little accompanying thorium is derived from external sources. The varnish forms a closed system for ^{230}Th and ^{231}Pa with equilibrium values for both $^{230}Th/^{234}U$ and $^{231}Pa/^{235}U$. Selective leaching of the ferromanganese oxides followed by analysis of both the leachate and silicate residue is proposed to allow age determinations.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 32472, 32552

32443 **(PNL-SA—9161) Behavior of REE in geological and biological systems.** Laul, J.C.; Weimer, W.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 5p. (CONF-810675—3). NTIS, PC A02/MF A01. Order Number DE81028201.

From 15. rare earth research conference; Rolla, MO, USA (15 Jun 1981).

The REE abundances when normalized to primordial (chondritic) abundances behave as a smooth function of the REE ionic radii in both the geological and biological systems. The REE are hardly fractionated chemically through various stages of their transformation from soil-soil extract-plant-geological systems.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 31665, 31667, 31716, 31752, 32432, 32448, 32464

32444 **(DOE/NV/00410—64) Environmental surveillance report for the Nevada Test Site (January 1980-December 1980).** Scoggins, W.A. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). 1981. Contract AC08-76NV00410. 185p. NTIS, PC A09/MF A01. Order Number DE81028034.

Results are presented for the environmental surveillance program at the Nevada Test Site as conducted by the Department of Energy (DOE) onsite radiological safety contractor from January 1980 through December 1980. The results and evaluations of measurements of radioactivity in air and water, and of direct gamma radiation exposure rates are presented. Relevancy to DOE concentration guides (CG'S) is established.

32445 **(EGG—1183-1756-Rev.1) Aerial radiological survey of the area surrounding the UNC Recovery Systems Facility, Wood River Junction, Rhode Island.** Bluitt, C.M. (EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group). May 1981. Contract AC08-76NV01183. 12p. NTIS, PC A02/MF A01. Order Number DE81025442.

An aerial radiological survey to measure terrestrial gamma radiation was carried out over the United Nuclear Corporation (UNC) Recovery Systems Facility located near Wood River Junction, Rhode Island. At the time of the survey (August 1979) materials were being processed at the facility. Gamma ray data were collected over a 3.28 km^2 area centered on the facility by flying north-south lines spaced 60 m apart. Processed data indicated that detected radioisotopes and their associated gamma ray exposure rates were consistent with those expected from normal background emitters, except directly over the UNC Facility. Average exposure rates 1 m above the ground, as calculated from the aerial data, are presented in the form of an isopleth map. No ground sample data were taken at the time of the aerial survey.

32446 **(PNL-SA—9122) Chemical species of migrating radionuclides at a shallow land low-level radioactive-waste burial site.** Kirby, L.J.; Toste, A.P.; Wilkerson, C.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 9p. (CONF-810722—9). NTIS, PC A02/MF A01. Order Number DE81028011.

From International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle; Knoxville, TN, USA (27 Jul 1981).

A research program at the Maxey Flats, Kentucky (U.S.A.) waste disposal site has been undertaken to define the chemical species contributing to the migration or retention of radionuclides contained in waste buried at that site. An experimental trench and inert atmosphere sampling wells were installed to sample water for determination of the chemical species of migrating radionuclides. The organic ligands are studied by gas chromatography, steric exclusion chromatography and mass spectrometry; and the data correlated with specific radionuclide counting data to determine precise chemical species. Preliminary data are reported in the text.

32447 **(PNL-SA—9123) Radionuclides in a deciduous forest surrounding a shallow-land-burial site in the eastern United States.** Rickard, W.H.; Kirby, L.J.; McShane, M.C. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 15p. (CONF-810722—11). NTIS, PC A02/MF A01. Order Number DE81028009.

From International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle; Knoxville, TN, USA (27 Jul 1981).

The objective of this study was to determine if radioactive materials buried in trenches at the Maxey Flats burial ground in eastern Kentucky have migrated into the surrounding oak-hickory forest. Forest floor litter, minearl soil, and tree leaves were sampled and the radionuclide content measured. (ACR)

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 31570, 31571, 31575, 31578, 31700, 31702, 31725, 31753, 31945, 32437

32448 **(DOE/EIS—0014-D) Mound Facility, Miamisburg, Ohio: draft environmental impact statement.** (Department of Energy, Washington, DC (USA)). Apr 1978. 272p. PCE 05/MF E05. Order Number DE81029829.

This environmental impact statement describes the ongoing work of all operations at the Mound Facility (formerly known as Mound Laboratory) and analyzes and evaluates the primary and secondary impacts on the environment that continuation of this work may entail. The majority of the facilities at this plant were in operation before Congress enacted the National Environmental Policy Act of 1969 (NEPA); therefore, no environmental impact statement within the context of the NEPA was required or made on these facilities prior to their construction and operation. The impacts of routine and accidental releases are addressed; however, the statement does not address any postulated effects of terrorists' actions or a catastrophic offsite transportation accident. Information is presented under the following section headings: summary; background; environmental impact; unavoidable adverse environmental effects; alternatives; relationship between short-term use and long-term productivity; relationship of present actions to any other land use plans, policies, and controls; irreversible and irretrievable commitments of resources; and environmental trade-off analysis. The appendixes are entitled: flora and fauna of the Miami Valley; atmospheric dispersion calculations; calculations for radionuclide uptake; plutonium toxicity; methods for calculating potential dose commitments; and glossary. (JGB)

32449 **Forests of the southeastern United States: quantitative maps for aboveground woody biomass, carbon, and dominance of major tree taxa.** Delcourt, H.R. (Oak Ridge National Lab., TN); West, D.C.; Delcourt, P.A. Contract W-7405-ENG-26. *Ecology ;* **62**: No. 4, 879-887(Aug 1981).

Summary maps presented in this paper depict the current distribution patterns of aboveground woody biomass and carbon content of commercial forests in the southeastern United States. Contour maps of dominance of 10 important southeastern tree taxa are included. These maps were compiled from growing-stock volume data available from the Continuous Forest Inventories (CFI) of the United States Department of Agriculture (USDA) Forest Service, Southern and Southeastern Forest Experiment Stations. The maps of woody biomass and carbon establish the current patterns for standing crop and carbon storage within forests of the southeastern United States, an area comprising 15% of the temperate forest zone of the earth. The contour maps of tree dominance quantify variation in composition within and between forest types previously mapped only qualitatively by the Forest Service. These dominance maps illustrate the individualistic nature of the distributions in response to gradients of environmental factors and effects of land management practices.

32450 **(LA-UR—81-899) Soil loss and leaching, habitat destruction, land and water demand in energy-crop monoculture: some quantitative limits.** Gutschick, V.P. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 12p. (CONF-811006—1). NTIS, PC A02/MF A01.

From International conference on energy use management--III; West Berlin, F.R. Germany (26 Oct 1981).

The environmental impacts of growing biomass for energy, especially for liquid automotive fuels, are potentially large. They are sensitive to the low power production per unit area (high land requirement) and to net energy balances. Initial quantitative estimates were made for impacts per unit power within several classes of impacts, and conversely, for limits to power produced if one avoids worst-class impacts. The following types of biomass energy technologies are considered: ethanol and methanol from grains and residues (temperate zone); jojoba wax (semi-tropical); ethanol from sugar cane and root crops (tropics); and silviculture for methanol via gasification.

32451 **(UCRL—15364) Cultural resource inventory of Lawrence Livermore National Laboratory's Site 300, Alameda and San Joaquin Counties, California.** Busby, C.I. (Basin Research Associates, Inc., Hayward, CA (USA)). May 1981. Contract W-7405-ENG-48. 149p. NTIS, PC A07/MF A01. Order Number DE81029640.

A Class III cultural resources inventory was undertaken of ca. 7000 acres of Lawrence Livermore National Laboratory's Site 300 property. Twenty-four cultural resource properties and twenty-five site types were located and recorded. Of the properties, three are prehistoric, twenty historic and one is a multicomponent site. Historic cultural resources comprise 83% of the total site assemblage. In terms of defined site types, historic petroglyphs and structures are the most representative of the recorded cultural resources. A brief site locale analysis, utilizing the inventory data, indicates that cultural resources occurrence is associated more strongly with the canyon-gully landforms than the foothills. Based on this analysis, it is probable that there is a greater probability of impacting cultural resources when projects occur in and around canyon-gully areas. The majority of the sites are either of CRES S3 or S4 significance (low significance) and while they merit consideration by Lawrence Livermore National Laboratory, that consideration should be mostly of a defensive nature.

32452 **Community structure and nutrient content of canopy arthropods in clearcut and uncut forest ecosystems.** Schowalter, T.D. (Univ. of Georgia, Athens); Webb, J.W.; Crossley, D.A. Jr. Contract W-7405-ENG-26. *Ecology ;* **62**: No. 4, 1010-1019(Aug 1981).

This paper describes differences in canopy arthropod community structure, major cation content, and calculated nutrient consumption between clearcut and undisturbed hardwood forest watersheds at Coweeta Hydrologic Laboratory, North Carolina, USA, during the first two growing seasons following cutting. Although canopy arthropod biomass was about 0.08% of foliage biomass on both watersheds, aphid mass increased 23-fold and ant mass increased 6-fold per unit foliage mass following cutting. These groups in general had lower nutrient concentrations than did chewing herbivores and predators. Arthropod K concentrations were 33% lower on the clearcut; Na, K, and Mg concentrations were 20 to 50% higher in 1978 than in 1977. Arthropod Mg and Ca concentrations, but not Na and K, were reduced significantly more by the greater effect of drought on the clearcut watershed. Consumption estimates based in part on consumption rates reported by others indicated increased nutrient translocation from foliage via arthropods following cutting. These data indicated that canopy arthropod responses to changes in nutrient availability following disturbance could have increased nutrient cycling rates and contributed to nutrient retention by the recovering ecosystem.

32453 **Remote sensing of natural resources. Quarterly literature review, January-March 1981.** Gonzales, R.W. (ed.). Albuquerque, NM; University of New Mexico (1981). 108p. (TAC-RS—81-001).

The first quarter of Remote Sensing of Natural Resources has undergone a face lift. In keeping abreast with the current trends within the literature some of the sections have been expanded and a new category of Engineering and Hazards Assessment has been added. As before, all of the documentation is related to the remote sensing of natural resources. Meteorology and extraterrestrial sensing are not selected (customized searches for these topics or any area of interest in remote sensing can be performed by contacting TAC). Sensors are primarily those operating within the ultraviolet through radar wavelength bands (10^{-1} to 1 meter).

5106 Regulations

REFER ALSO TO CITATION(S) 31618, 32467

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 32555

32454 **(PB—81-105405) Water resources data for Ohio, water year 1979. Volume 3. Coal areas. Water-data report (annual) 1 October 1978-30 September 1979.** (Geological Survey, Columbus, OH (USA). Water Resources Div.). Jul 1980. 169p. NTIS, PC A08/MF A01.

Water resources data for the 1979 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in three volumes contains records for water discharge at 197 gaging stations; stage and contents at 32 lakes and reservoirs; water quality at 54 gaging stations and 49 wells; and water levels at 157 observation wells. Also included are data for 58 crest-stage partial-record stations; 26 low-flow partial-record stations, and 311 coal hydrology synoptic sites.

32455 **(PB—81-112625) Development of a simple means for predicting algal blooms.** Litten, S.; Effler, S.W.; Meyer, M. (Syracuse Univ., NY (USA). Dept. of Civil Engineering). Sep 1980. Contract DI-14-34-0001-9086. 56p. NTIS, PC A04/MF A01.

A simple technique to predict the future occurrence of algal blooms was evaluated for seven test lake systems proximate to Syracuse, NY during the summer of 1978 and 1979. The selected test systems represent a broad range of trophic status, from mesotrophic to hypereutrophic. The technique includes a simple filtering process followed by the identification of the color imparted to the filter, based on comparison to National Bureau of Standards' color chips. The reference measure of phytoplankton standing crop was chlorophyll-a. Particular colors of filtered particulates were not demonstrated to be useful estimators of chlorophyll-a concentration, though the hues olive and yellow-green were associated with

higher chlorophyll-a levels. The particulate color method was demonstrated to be useful in following certain physical/chemical changes in a lake.

32456 **(PB—81-130049) Movements of lake trout in Twin Lakes, Colorado, in relation to the Mt. Elbert pumped-storage powerplant.** Walch, L.A. (Colorado Cooperative Fishery Research Unit, Fort Collins (USA)). Jul 1980. 71p. NTIS, PC A04/MF A01.

Mean movement rates of 34 lake trout (Salvelinus namaycush) tagged with ultrasonic transmitters in Twin Lakes, Colorado, ranged from 1.1 m/min in the fall to 1.6 m/min in the summer. Movement rates between 0830 and 1130 were significantly higher than between 2230 and 0500 during spring, summer, and fall. During the fall, afternoon movements were significantly greater than night movements. It is likely that the lake trout of Twin Lakes will be least vulnerable to entrainment by pumping operations between 2230 and 0500 and most vulnerable between 0830 and 1130 during spring, summer, and fall. Seasonally, they will be least vulnerable in the winter and most vulnerable in the spring.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 31573, 31663, 31746, 32415, 32419, 32472, 32592

32457 **(BNL—29793) Effects of acidification on aquatic primary producers and decomposers.** Hendrey, G.R. (Brookhaven National Lab., Upton, NY (USA)). Jun 1981. Contract AC02-76CH00016. 30p. (CONF-810843—1). NTIS, PC A03/MF A01. Order Number DE81025874.

From Acid rain/fisheries symposium; Ithaca, NY, USA (2 Aug 1981).

Acidification of nutrient-poor, clearwater lakes and streams is associated with a variety of changes in communities of aquatic organisms. While acidification may eliminate fish, it does not kill the lake. Some species become very abundant in acidified waters and the balance among organisms, which provide stability to the aquatic ecosystem, is lost. This is reflected in accumulations of algae and dead plant litter. While these kinds of changes are observed, studies which quantitatively link the effects of acidification at one ecological level to changes in some other level are lacking. One can only surmise that such links are significant to ecosystem structure and functioning.

32458 **(DOE/EV/10253—2) Hydrodynamic and chemical modeling of heavy metals in ash pond leachates. Progress report, July 1, 1980-August 31, 1981.** Theis, T.L.; Kirkner, D.J.; Jennings, A.A. (Notre Dame Univ., IN (USA). Dept. of Civil Engineering). Aug 1981. Contract AC02-79EV10253. 55p. NTIS, PC A04/MF A01. Order Number DE81028510.

This report details progress on the development and application of advanced subsurface solute transport models through August 31, 1981. The goal is to develop models which are capable of describing both the physical and chemical factors which affect the transport of solutes through a porous media. Of special concern is the inclusion of complex solution and soil chemical interactions which are known to be of importance in the leachates and soils associated with wastes produced from energy production. At the present time one-dimensional saturated flow multi-solute finite element models for flow in a homogeneous medium have been developed. These include the effects of dispersive and convective mass transport and the chemical factors of nonlinear ion exchange and adsorption, and solution phase complex formation. The effects of pH, E/sub h/ and ionic strength are included; however they must be specified as dependent variables which are a function of space. In the report the derivation of the governing equations is summarized and the numerical techniques and algorithms used to achieve a solution are described. An analysis of the accuracy of the solutions is given and both hypothetical and actual simulations are presented which describe the combined effects of convection, dispersion, ion exchange or adsorption, and soluble complex formation among solutes. The Appendix consists of a preliminary program plan which describes the approach to the research among all the groups involved, the division of the research effort, and the existing and anticipated collaboration.

32459 **(PB—81-130676) Chemical quality of water from community systems in New York, November 1970 to May 1975.** Cartwright, R.H.; Ziarno, J.A. (Geological Survey, Albany, NY (USA). Water Resources Div.). Sep 1980. 445p. NTIS, PC A19/MF A01.

Chemical analyses of 2,802 water samples from 784 of approximately 1,500 community water systems in the State of New York are presented. The data were collected from November 1970 to May 1975. The analyses include physical properties, major and minor constituents, pesticide residues, and radiochemical data. Some bottom-material analyses are included.

32460 **(PNL-SA—9584) Speciation of aqueous contaminants: role of the geochemical model.** Jenne, E.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1981. Contract AC05-76RL01830. 15p. (CONF-810588—4). NTIS, PC A02/MF A01. Order Number DE81029976.

From DOE/NBS workshop on environmental speciation and monitoring needs; Gaithersburg, MD, USA (18 May 1981).

A combination of accurate, selected analytical determinations and a competent geochemical model constitutes the only possible means of achieving a sufficiently thorough and reliable aqueous speciation of waters for the evaluation of societal risks resulting from anthropogenic inputs from energy related technologies. Thorough aqueous speciation is essential to adequately estimate the thermodynamic activity of those solute species having biological availability, hence toxicity, as well as high sorption potential. A reliable calculation of the distribution of species requires analytical determination of: (1) the quantity of each element in true solution; and (2) the amount of quantitatively and/or environmentally important aqueous species which are in disequilibrium. Because redox couples are rarely at equilibrium, the quantity of each redox state of multiple valence-state elements must be analytically determined. Due to the: (1) very numerous organic compounds which may be present; (2) the absence of Gibbs free energy and enthalpy data defining the association of these organic compounds with trace and major elements; and (3) the lack of competence of speciation-solubility models for organic ligands, the quantity of organic, trace-element complexes must, at the moment, be addressed analytically.

32461 **Formation of particulate organic carbon in water from a southeastern swamp-stream.** Mulholland, P.J. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Limnology and Oceanography ;* **26**: No. 4, 790-795(Jul 1981).

The rate of particulate organic carbon (POC) formation in water from a small North Carolina swamp-stream, low in ionic strength but high in dissolved organic carbon (DOC), was low. Mean POC formation rate, expressed as DOC utilization, was about 0.2% of DOC per day and was primarily the result of microbial activity. When Ca^{2+} and Hg^{2+} were added to swamp water, and when swamp water and seawater were mixed, the rate of POC formation increased as a result of a rapid physiochemical flocculation process. Although the DOC load of rivers and streams of the southeastern US represents a substantial energy input to estuarine regions, these results indicate that only about 25 to 30% of it is transformed through flocculation to a form more readily retained and utilized within the estuarine system. The remainder may be transported to the sea.

32462 **The land and hazardous waste management.** Pizzuto, J.S.; Townley, C.W. (Battelle Columbus Labs, Ohio). *Journal of Soil and Water Conservation ;* **36**: No. 2, 79-81(Mar-Apr 1981).

The disposal of hazardous wastes in landfills can create serious environmental problems, as evidenced by the chemical contamination incident at Love Canal, N.Y. Disposal of these wastes, which include chemical residues, heavy metals, radioactive wastes, and flammable materials, pose threats to groundwater resources. Legislative remedies partially eliminate these hazards. Alternative disposal methods, including incineration, waste-to-energy treatments, and permanent storage facilities should be encouraged.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 31731, 32432, 32444, 32539

32463 (ORNL/TM—7323) Investigation of radionuclide release from Solid Waste Disposal Area 3, Oak Ridge National Laboratory. Stueber, A.M.; Webster, D.A.; Munro, I.L.; Farrow, N.D.; Scott, T.G. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 59p. NTIS, PC A04/MF A01. Order Number DE81030260.

Radionuclide release from Solid Waste Disposal Area (SWDA) 3 has been studied through the analysis of surface and ground waters from the local drainage areas. SWDA 3 is located in the Northwest Tributary drainage basin, a part of the White Oak Creek drainage; ^{90}Sr is the only radionuclide being discharged in solution in the main stream. Water-level measurements in wells around SWDA 3 suggest the presence of a ground-water divide beneath the southwestern end of the disposal area. Ground water below this area may be moving southwestward toward the Raccoon Creek drainage system. Strontium-90 activity has been detected in this watershed, discharging from a seep adjacent to a Raccoon Creek tributary stream about 640 m southwest of SWDA 3. It appears that ^{90}Sr is moving through ground-water flow to the northeast and to the southwest of SWDA 3 and that this direction of movement is related to bedrock structure. The trend of a line connecting the two seeps passes through the disposal area and is parallel to bedrock strike. Information from core-hole logs and televiewer logs suggests that ^{90}Sr in ground water may be moving through solution channels near the contact between units F and G of the Chickamauga Limestone. The apparent extent of migration of ^{90}Sr in bedrock has implications regarding potential underground radionuclide movement in Melton Valley.

32464 Estimating system equilibrium from response to an input of short duration. Travis, C.C.; Haddock, G. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Computers and Mathematics with Applications ;* 6: 247-249(1980).

It is established that the time integrated system response to a unit pulse is numerically equal to the equilibrium state under a continuous unit input. Extensions to nonlinear systems are discussed.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 31588, 31718, 31719, 31720, 31721, 31723, 31732, 31733, 31734, 31736, 31737, 31738, 31739, 31742, 32448, 32450, 32473

32465 Aquaculture siting issues in Washington's coastal zone. Evans, N. (Department of Energy, Seattle, WA). *Coastal Zone Management Journal ;* 8: No. 3, 189-213(1980).

Greater commitments of aquatic resources are required as aquaculture activities expand and intensify. At the same time, increasing recreational and residential uses of the coast are placing other demands on many of the same resources. Multiple use disputes are arising and conflicts are intensifying. This paper is a problem analysis based on recent public debates in the state of Washington which surrounded the mechanical harvest of clams, raft culture of mussels, and pen rearing of salmon. Subjects of potential conflict are shown in the questions of continuing the subtidal harvest of geoducks, raft culturing of marine algae for food and chemical extracts, and continuing the use of public nearshore aquatic areas for private oyster farming. This report also suggests that better coastal management techniques need to be developed which address: (1) how environmental impacts and risks are determined; (2) how claims for esthetic quality can be evaluated and measured; and (3) which methods can be used to plan for the aquatic areas which recognize the special features of the aquatic areas.

5206 Regulations

REFER ALSO TO CITATION(S) 31618

32466 (MIT-EL—79-019) Water-rights-transfer evaluation procedure with applications for Western energy development. Gerstle, J.H.; Marks, D.H. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Feb 1979. Contract AM01-76EI02295. 75p. NTIS, PC A04/MF A01. Order Number DE81029732.

This report deals with questions of water supply for coal development in the semiarid western United States. A method is developed to evaluate yields of water rights in appropriation or permit systems of water administration. Water rights are characterized in terms of location, priority, decreed maximum diversion, actual diversion in periods of low flow, and consumptive use. Transfers of water rights are evaluated in this method by using institutional procedures as framework for analysis. A case study is performed on the North Fork of the Powder River, Wyoming, in which institutional considerations are discussed, and water rights are evaluated for a hypothetical facility. This procedure is not limited to energy facilities but may be used in most cases of water rights transfers. The method is designed for use with easily obtained data in order to facilitate its use in practice.

32467 (PNL-SA—9292) Ecological effects assessment: requirements vs state-of-the-art. McKenzie, D.H.; Thomas, J.M.; Eberhardt, L.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 31p. (CONF-810545—5). NTIS, PC A03/MF A01. Order Number DE81028092.

From 3. conference on waste heat management and utilization; Miami, FL, USA (12 May 1981).

Concerns for environmental quality, the ecologist's understanding of ecosystems, and the ability to quantitatively sample and evaluate hypotheses have contributed to current requirements and the state-of-the-art in ecological effects assessments in refard to nuclear power plants. The current cooling system approaches, data collection programs, and ecological effects assessments reflect these contributions. Over a decade of experience provides the basis for a timely review and evaluation of current proactice. The magnitude of economic and environmental resources being committed to cooling system alternatives mandates that the decision-making process result in as many optimal choices as possible. In addition, the resources being devoted to environmental data collection and integration provide considerable motivation for providing meaningful input to the decision-making process. It is maintained that the input should be as quantitative and as free from subjective content as is reasonably possible. An alternative viewpoint suggests that the past several decades of experience be considered but a first step, and the current task to be one of designing a second step.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 31809, 31827, 32515

32468 (K/OA—4662(Rev.1)) Economic analysis of PCB disposal. Toomer, L.C.; Leone, S.M. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 28 Aug 1981. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE81029763.

Environmental Protection Agency (EPA) regulations require that polychlorinated biphenyl (PCB) liquids and waste stored for disposal must be disposed of by January 1, 1984. Future accumulations must be disposed of within one year. The regulations permit the continued use of totally enclosed PCB in transformers and capacitors which make up the bulk of the material at Oak Ridge Operations sites. Timing for the eventual disposal of this totally enclosed material is very indefinite. The quantities of PCB are summarized by site. This includes not only the material currently on hand but also the solvents needed to rinse transformers, shipping containers, etc., when the PCB is ready for disposal. The immediate problem is to provide incineration capacity to dispose of 581,000 pounds of stored liquid PCB prior to January 1, 1984. In addition

there are small quantities of solid PCB. The Oak Ridge area is the only location that has been considered as an incinerator site because almost all the PCB currently stored for disposal is located at the K-25 and Y-12 plants. In addition, Oak Ridge has the largest total quantities of PCB and construction costs are less than at either Paducah or Portsmouth. Two sizes of liquid incinerators were evaluated, 2000 lbs/day and 4000 lbs/day facilities. The incinerators must meet the requirements of the EPA regulations which were issued May 31, 1979. As shown in tabulated data the 2000 lbs/day unit is capable of processing all the PCB stored for disposal in 10 months. Therefore, a facility of this size should be ready for startup by the first of 1983 in order to meet the disposal deadline of January 1, 1984. The larger 4000 lbs/day facility will require only 5 months to complete the initial disposal and therefore startup could be delayed until the middle of 1983. It has been estimated that the 2000 lbs/day facility will cost 90% as much as the 4000 lbs/day facility largely because the same extensive instrumentation will be required for each.

32469 **(ORAU—181B) Individual biomass facility reports supplement to some employment and earnings implications of regional biomass energy utilization: New England and the cornbelt states.** (Oak Ridge Associated Universities, Inc., TN (USA)). Aug 1981. Contract AC05-76OR00033. 155p. NTIS, PC A08/MF A01. Order Number DE81028523.

Research was conducted to determine the direct employment and earnings implications of regional biomass energy utilization. This document provides details of the primary data collected during the course of the investigation. A case studies approach was used to observe and analyze various biomass energy systems. Visits were made to existing biomass facilities and data on their operation and employment requirements were collected. Information on planned or potential future facilities was also obtained. When this information was analyzed, a fairly accurate picture of the current situation as well as the rate and direction of future development in biomass can be attained. Separate descriptions are included for each facility visited or for each interview obtained. The facility reports are organized according to fuel cycle (wood-fuel, alcohol-fuel, municipal solid waste facilities, others). (DMC)

32470 **(ORNL/TM—7892) Preliminary analysis of projected construction employment effects of building the defense waste processing facility at the Savannah River Plant.** Garey, R.B.; Blair, L.M.; Craig, R.L.; Stevenson, W. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1981. Contract W-7405-ENG-26. 219p. NTIS, PC A10/MF A01. Order Number DE81030261.

This study estimates the probable effects of constructing the DWPF on the surrounding labor markets. Analyses are based on data from the local and regional labor markets, information from experts on local construction activities, information on the labor requirements of the Vogtle Power Plant (two nuclear reactors) being built by Georgia Power Company in Burke County, Georgia, and an econometric model of the construction labor market, based on several surveys of workers building three Tennessee Valley Authority nuclear power plants. The results of this study are reported in three parts. In Part I, completed in May 1980, we describe the 1979 (base year) employment levels within the local and regional labor markets surrounding SRP, from which most DWPF construction workers are likely to be drawn. In Part II, completed in June 1980, we define the four local sources of construction employment that will compete for craftsmen when DWPF is built. Also in Part II, most of the projected impacts of the DWPF reference immobilization alternative (one of several alternatives that may be chosen) are reported. Several construction schedules and labor demand scenarios for the reference alternative are considered. In Part III, completed in January 1981, most of the estimated impacts of the DWPF alternative referred to as the staged process alternative are reported. Several construction schedules and labor demand scenarios for this alternative are considered.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 31844, 32450

32471 (ORNL—5806, pp 26-36) **Environmental Sciences Division.** Jul 1981. NTIS, PC A04/MF A01.

In Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.

The Environmental Sciences Division conducts research on the development, siting, and use of energy technologies in order to enhance environmental acceptability. The primary objective of their research programs is to understand more precisely how biological and physical processes interact to regulate the transport, fate and effects of materials in the atmosphere as well as the aquatic and terrestrial ecosystems. The 5 major programs of the division: advanced fossil energy, fuels from biomass, environmental impact, low level waste research and development and toxic substances are discussed and the recent major accomplishments of the division are listed. (KRM)

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 31571, 31639, 31640

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

REFER ALSO TO CITATION(S) 32456, 32514, 32573

32472 (EPA/600/9—81-001, pp 341-357) **Health effects of air pollutants in the Texas Gulf Coast area.** Chapman, R.S. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Planned epidemiologic studies of the US EPA's Health Effects Research Laboratory are described for the Texas Gulf Coast area. (DLS)

32473 **(PB—81-131765) Aspects of the population dynamics of striped bass (Morone saxatilis) spawning in Maryland tributaries of the Chesapeake Bay.** Kohlenstein, L.C. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.; Maryland Dept. of Natural Resources, Annapolis (USA)). Feb 1980. 189p. NTIS, PC A09/MF A01.

This is a study of mortality and migration processes that influence the population structure and harvest of adult striped bass spawned in the Maryland tributaries of the Chesapeake Bay and an examination of the influence of stock size on the reproductive success of the population. A model of the adult stock was developed that incorporates the age and sex specific nature of Striped Bass migratory patterns and mortality rates. The model was used to address a number of resource management issues including estimating the effects of a 14 inch minimum size limit in Maryland and the consequences of a reduction in year class strength through power plant operations.

32474 **Liquid scintillation counting for ^{14}C uptake of single algal cells isolated from natural samples.** Rivkin, R.B.; Seliger, H.H. (Johns Hopkins Univ., Baltimore, MD). Contract EY-76-S-20-3278. *Limnology and Oceanography ;* **26**: No. 4, 780-785(Jul 1981).

Short term rates of ^{14}C uptake for single cells and small numbers of isolated algal cells of five phytoplankton species from natural populations were measured by liquid scintillation counting. Regression analysis of uptake rates per cell for cells isolated from unialgal cultures of seven species of dinoflagellates, ranging in volume from ca. 10^3 to 10^7 μm^3, gave results identical to uptake rates per cell measured by conventional ^{14}C techniques. Relative standard errors or regression coefficients ranged between 3 and

10%, indicating that for any species there was little variation in photosynthesis per cell.

32475 Abundance, diversity, and resource use in an assemblage of Conus species in Enewetak lagoon. Kohn, A.J. Contract AT-(29-2)-226;AT-(26-1)-628. *Pacific Science ;* **34**: No. 4, 359-369(Oct 1980).

Eight species of the gastropod genus Conus co-occur in sand substrate and an adjacent meadow of Halimeda stuposa in Enewetak lagoon, an unusually diverse assemblage for this type of habitat. Population density is high, and large species predominate; they represent all major feeding groups in the genus: predators on polychaetes, enteropneusts, gastropods, and fishes. Although the two most common Conus species eat primarily the same prey species, they mainly take prey of different sizes in different microhabitats. The results suggest that sufficient microhabitat heterogeneity and prey diversity exist to permit spatial segregation and specialization on different prey resources by the different Conus species present. Between-species dissimilarity in resource use thus agrees with previous observations on more diverse Conus assemblages of subtidal coral reef platforms. Prey species diversity is inversely related to body size, confirming and extending a previously identified pattern among Conus species that prey on sedentary polychaetes.

5502 Biochemistry

REFER ALSO TO CITATION(S) 31811, 32474, 32499, 32534, 32552, 32559, 32568, 32569, 32576

32476 (BNL—29466) ^{31}P NMR studies of oriented multilayers formed from isolated sarcoplasmic reticulum and reconstituted sarcoplasmic reticulum: evidence that boundary-layer phospholipid is not immobilized. McLaughlin, A.C.; Herbette, L.; Blasie, J.K.; Wang, C.T.; Hymel, L.; Fleischer, S. (Brookhaven National Lab., Upton, NY (USA); Pennsylvania Univ., Philadelphia (USA); Vanderbilt Univ., Nashville, TN (USA). Dept. of Molecular Biology). 1981. Contract AC02-76CH00016. 6p. (CONF-811009—1). NTIS, PC A02/MF A01. Order Number DE81021388.

From Biophysical discussion on protein-lipid interaction in membranes; Airlie House, VA, USA (3 Oct 1981).

The major protein constituent of the sarcoplasmic reticulum is the calcium-pump protein which has been dissociated from the sarcoplasmic reticulum membrane and reconstituted to form functional membrane vesicles. The angular dependence of the ^{31}P NMR signal from oriented sarcoplasmic reticulum membranes was obtained. Similar spectra were obtained from oriented reconstituted sarcoplasmic reticulum membranes with lipid-to-protein ratios ranging from 42:1 to 110:1 and from oriented bilayer membranes formed from sarcoplasmic reticulum phospholipids. Two conclusions were drawn from the ^{31}P NMR spectra about the motion of the phospholipid molecules that contribute to the observed spectra. First, the phosphate group and the two adjacent methylene groups are able to rapidly rotate around the normal to the plane of the membrane. Second, the restricted internal motion of the phosphate group and the glycerol CH_2OP group is very similar to that found in liposomes formed from sarcoplasmic reticulum phospholipids. Calibration experiments showed that all of the phospholipid molecules in the membranes can be accounted for in the observed spectra. Thus, essentially all the phospholipid molecules in the sarcoplasmic reticulum and the reconstituted sarcoplasmic reticulum membranes have the same motion in the polar headgroup region as found in model bilayer membranes. Since a large fraction of the phospholipid molecules are immediately surrounding the calcium-pump protein it was concluded that the calcium-pump protein does not perturb the motion of these boundary-layer lipids. (ERB)

32477 (BNL—29738) Peptidyl chloromethyl ketones and diazomethyl ketones as protease affinity labels. Shaw, E.; Kettner, C.; Green, G.D.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 17p. (CONF-8106129—1). NTIS, PC A02/MF A01. Order Number DE81027305.

From 7. annual peptide symposium; Madison, WI, USA (15 Jun 1981).

Described are chemical preparations and biochemical uses of chloromethyl and diazomethyl ketones as protease affinity labels. Uses of these ketones for substrate selectivity studies, enzyme inhibition, and enzyme mechanisms are discussed for thrombin, kallikrein, and thiol proteases. (DLS)

32478 (DOE/ER/03827—6) Stereoelectronic properties of aggregated chlorophyll systems. Progress report, January 1, 1980-December 31, 1981. Maggiora, G.M. (Kansas Univ., Lawrence (USA). Dept. of Chemistry). Aug 1980. Contract AS02-76ER02837. 39p. NTIS, PC A03/MF A01. Order Number DE81028513.

During the first eight months of the current contrac year substantial progress has been made in several areas. Quantum mechanical characterization of Chl and BChl systems has continued. SCF MO CI calculations on the π-anion radicals of Chl a and Pheo a, on the enol form of Chl a, and on a model dimer of porphine were completed. Similar calculations are currently in progress on Pheo a enol and anthroquinone (an analog of plastoquinone). An analysis of S(-2k) dipole sums (Cauchy coefficients) has recently been published, and a fitting procedure for obtaining consistent S(-2k) dipole sums from optical refractivity data has been developed and applied to a large number of molecules. A manuscript describing the details of an empirical potential function procedure developed to study the structure of the components of photosynthetic systems has also been accepted for publication; and preliminary studies aimed at developing a quadratic valence force field for studying Chl species are underway.

32479 Application of arabinofuranosyl cytosine in the kinetic analysis and quantitation of DNA repair in human cells after ultraviolet irradiation. Snyder, R.D.; Carrier, W.L.; Regabn, J.D. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Biophysical Journal ;* **35**: No. 2, 339-350(Aug 1981).

We have developed a technique whereby 3-h pulses of arabinofuranosyl cytosine (ara-C) and hydroxyurea (HU) are used to analyze the kinetics of repair with time after ultraviolet irradiation in human fibroblasts. We demonstrate that this technique offers a significant improvement over existing repair assays in its ability to visualize between 57 and 100% of all sites undergoing repair in a given period of time. In addition, kinetic analyses of repair are more easily made and yield more information than techniques such as repair replication or unscheduled DNA synthesis. We have also examined the nature of the inhibition event by ara-C and have determined that repair breaks accumulate in the presence of ara-C and HU only up to a certain time beyond which no further breaks appear. The time needed to reach this saturation point depends on the number of sites undergoing repair during the treatment time. This observation is discussed with respect to a possible mechanism of excision repair inhibition by ara-C and HU.

32480 Interaction of hepatic cytochrome P-450 with organic solvents. Backes, W.L.; Canady, W.J. (West Virginia Univ., Morgantown). Contract EY-77-C-21-8087. *Journal of Biological Chemistry ;* **256**: No. 14, 7213-7227(25 Jul 1981).

Studies have been undertaken to explain the observed variation of the apparent association constant for water-insoluble substrates, which were diluted in common organic solvents, as a direct function of the solvent/solute ratio. By the use of suitable equations, the solvents methanol, ethanol, propanol, and acetone are shown to interact with hydrocarbon substrates in a competitive manner in PB-treated male rats, with the solvent producing a type I spectral component. Such solvents are shown to elicit, in addition to the type I component, a modified type II component. In untreated rats, ethanol does not produce a type I component, and also does not affect the apparent association constant for the hydrocrbon substrates when used as a solvent for those substrates. All perturbations of the enzyme which cause a change in the apparent association constant of the substrate also cause a quantitatively similar change in the apparent association of the solvent for the enzyme. A sex difference, with respect to competitive solvent binding, is also observed. Cytochrome P-450 from untreated male rats is apparently unable to bind small polar solvent substrates at the hydrocarbon binding site, whereas untreated female rats possess such an ability. In PB-treated rats, solvent binding is found to be sex-dependent. With respect to PB induction in female rats, the binding affinity for ethanol in the PB-treated animals is significantly larger than that observed in untreated females.

32481 DNA repair in human fibroblasts treated with a combination of chemicals. Ahmed, F.E.; Setlow, R.B. (Brookhaven National Lab., Upton, NY). *Biophysical Journal ;* **35**: No. 1, 17-22(Jul 1981).

Excision repair of DNA damage was measured by the photolysis of bromodeoxyuridine incorporated during repair in normal human and xeroderma pigmentosum group C fibroblasts (XP C) treated with a combination of the carcinogens N-acetoxy-2-acetylamino fluorene (AAAF), and 4-nitroquinoline 1-oxide (4NQO). Repair was additive in normal and XP C cells treated with AAAF plus 4NQO, indicating that there are different rate limiting steps for removal of 4NQO and AAAF lesions.

32482 Primary structure, gene organization and polypeptide expression of poliovirus RNA. Kitamura, N. (State Univ. of New York, Stony Brook); Semler, B.L.; Rothberg, P.G. *Nature (London) ;* **291**: No. 5816, 547-553(18 Jun 1981).

The primary structure of the poliovirus genome has been determined. The RNA molecule is 7433 nucleotides long, polyadenylated at the 3′ terminus, and covalently linked to a small protein (VPg) at the 5′ terminus. An open reading frame of 2207 consecutive triplets spans over 89% of the nucleotide sequence and codes for the viral polyprotein NCVPOO. Twelve viral polypeptides have been mapped by amino acid sequence analysis and were found to be proteolytic cleavage products of the polyprotein, cleavages occurring predominantly at Gln-Gly pairs.

32483 Dynamics of cellular and extracellular cAMP in Anabaena flos-aquae (Cyanophyta): intrinsic culture variability and correlation with metabolic variables. Francko, D.A.; Wetzel, R.G. (Michigan State Univ., Hickory Corners). Contract EY-76-S-02-1599. *Journal of Phycology ;* **17**: No. 2, 129-134(Jun 1981).

The production and extracellular release of cyclic adenosine 3′:5′-monophosphate (cAMP) by the blue-green alga Anabaena flos-aquae (Lyngb.) Breb. varied greatly within and between active growth phase and stationary phase and under differing nutrient regimes. Enhanced cellular cAMP production was found in actively growing Anaebaena inoculated into media deficient in nitrate or phosphate, or into fresh media containing non-limiting nutrient concentrations. In stationary phase Anabaena, but not actively growing cells, the concentrations of intracellular cAMP present in cells grown under a variety of nutrient regimes could be significantly correlated to [^{14}C]-bicarbonate uptake by an exponential relationship.

32484 Location of platinum binding sites on bacteriorhodopsin by electron diffraction. Dumont, M.E.; Wiggins, J.W.; Hayward, S.B. (Johns Hopkins Univ., Baltimore, MD). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 5, 2947-2951(May 1981).

A platinum-containing derivative of bacteriorhodopsin has been prepared by treating purple membranes with glycyl-L-methionatoplatinum. Low-dose electron diffraction was used to identify Pt binding sites in the 5.6 A resolution reconstruction of the bacteriorhodopsin unit cell in projection. This is a necessary first step in the use of the Pt derivative for identifying the parts of the amino acid sequence corresponding to the α helices in the bacteriorhodopsin structure and for obtaining phases for reflections out to 3.5 A resolution by the method of heavy-atom isomorphous replacement. The largest peak in a Fourier difference map between platinum-labeled and native purple membrane is larger than thespurious features expected to arise from errors in measurements of diffraction intensities.

32485 Oscillations and control features in glycolysis: numerical analysis of a comprehensive model. Termonia, Y.; Ross, J. (Stanford Univ., CA). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 5, 2952-2956(May 1981).

We present an analysis of glycolysis based on experimental findings and an interpretation based on concepts of efficiency, resonance response, and control features available in highly nonlinear reaction kinetics. We begin with a model for the glycolytic mechanism that is comprehensive, includes a large number of known activations and inhibitions of enzymes by metabolites, and couples the phosphofructokinase (PFKase) and the pyruvate kinase (PKase) reactions. We use experimental data to obtain the best estimates for the kinetic parameters and test the model by calculating the concentration variations of the intermediate metabolites. Our model shows that the average ATP/ADP ratio is increased and the average free-energy dissipation is decreased in an oscillatory compared with a steady state mode of operation. The average values of the ATP/ADP ratio and of the free energy dissipation change abruptly past the onset of sustained oscillations.

32486 Monomeric chlorophyll a enol: evidence for its possible role as the primary electron donor in photosystem I of plant photosynthesis. Wasielewski, M.R.; Norris, J.R.; Shipman, L.L.; Lin, C.P.; Svec, W.A. (Argonne National Lab., IL). *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 5, 2957-2961(May 1981).

The chlorophyll a (Chl a) special-pair model of the primary donor of photosystem I (P700) does not account in a completely adequate fashion for the magnetic resonance properties observed for $P700^+$. Enolization of the Chl a ring V β-keto ester results in a very different π electronic structure. The ESR spectrum of the cation radical consists of a single 6.1-G gaussian line that is line narrowed relative to that of Chl a^+ in a manner similar to $P700^+$. Electron-nuclear double resonance (ENDOR) spectroscopy resolves only a 3.5-MHz hyperfine splitting for the 3-methyl group. The remaining splittings are all less than 3.5 MHz. Application of the special-pair model to the [^{13}C]$P700^+$ second-moment data yields a 100% error. Ab initio molecular orbital calculations on ethyl chlorophyllide a enol cation bear out the ESR and ENDOR data. We conclude that a monomeric Chl a enol model provides a better description of the magnetic resonance parameters and oxidation potential of P700 than a Chl-a special-pair model.

32487 Criteria for the reconstitution of ion transport systems. Shamoo, A.E.; Tivol, W.F. (Univ. of Rochester School of Medicine and Dentistry, NY). pp 57-126 of Current topics in membranes and transport. Bronner, F. (ed.). New York, NY; Academic Press, Inc. (1980).

The reconstitution of ion transport systems allows detailed investigation of their properties, but in order for these investigations to be meaningful it must be shown how the system in question is related to the native membrane. Since the original membrane may contain components which interact with the system of interest and modify its properties, measurements of membrane function are not sufficient and methods of measurement which yield other information about the structure and function of both the native and reconstituted systems must be used to compare the systems. Although native and reconstituted systems may appear identical by certain criteria they may well differ in detail, so as many independent measurements as practical should be performed. The range of properties measurable in reconstituted systems is extremely broad, encompassing specific lipid requirements, kinetics, stoichiometry, and variations in properties as functions of pH, transmembrane voltage, temperature, or composition of aqueous phase on each side of the membrane. Reassembly of fragments of an ion transport system can give information regarding the localization of functional sites within the system. In this case reassembly will not yield a system identical to the native system and measurements relating the partially reconstituted system to the native system are particularly important to assure that any conclusions derived are not based on artifacts.

32488 Interaction of poly(L-lysine) and copolymers of lysine with immobilized DNA. Nicola, N.A.; Kristjansson, J.K.; Fasman, G.D. (Brandeis Univ., Waltham, MA). Contract EP-78-S-02-4962.A000. *Archives of Biochemistry and Biophysics ;* **193**: No. 1, 204-212(Mar 1979).

Sonicated DNA has been covalently attached to Sepharose 4B by a carbodiimide method which minimizes modification of the DNA and matrix. Columns of this material have been used to study the interaction between cationic polypeptides and DNA. When poly(L-lysine) is bound to such columns at low ionic strength and then eluted with a linear salt gradient the polypeptide elutes over a broad range of salt concentration, presumably reflecting different strengths of interaction with various sites on the DNA. The broadness of the elution profile cannot be attributed to heterogeneity in

the poly(L-lysine) sample but rather to the AT/GC content of various DNA sites.

32489 (DOE/ER/01426—T1) Technical progress report. (Colorado Univ., Boulder (USA). Dept. of Chemistry). [nd]. Contract AS02-76ER01426. 12p. NTIS, PC A02/MF A01. Order Number DE81026303.

Recent investigations have shown that plant cell wall polysaccharides have regulatory functions as well as structural functions. Evidence has been obtained that fragments of cell wall polymers are hormones. Such hormones are termed oligosaccharins in this paper. Eight such oligosaccharins are herein described. (ACR)

5503 Cytology

REFER ALSO TO CITATION(S) 32476, 32487, 32559, 32560, 32562, 32568, 32569, 32700

32490 (ANL—80-115-Part2, pp 22-27) **Measurements of the mucous membranes in human paranasal sinuses and mastoids.** Harris, M.J. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Measurements taken on eight new autopsy cases from the CHR collection expand the data base for normal epithelial and lamina propria thicknesses of paranasal sinuses and mastoid air cells. The ratios of nuclear area to epithelial cellular area calculated in this series are in close agreement with those of earlier reports.

32491 (ANL—80-115-Part2, pp 42-51) **Further studies on the suppression of growth of two osteosarcoma cell lines by normal cells using alkaline phosphatase.** Gemmell, M.A.; Henning, C.B.; Lloyd, E.L. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Two osteosarcoma cell lines (TE-85 and SaOS-2) were cocultivated with four different normal human cell strains of both fibroblastic and epithelial origin. In all cases, the expression of the tumor cells was progressively suppressed as the number of the normal cells was increased. In addition, the tumor cells in contact with normal fibroblasts took on the spindle-shaped appearance of the fibroblasts although they stained positively for alkaline phosphatase which was used throughout as a specific enzyme marker for the osteosarcoma cells.

32492 (DOE/EV/05854—T1) Repair of lesions and initiation of DNA replication in vertebrate cells. Progress report, December 1, 1981-November 30, 1982. Taylor, J.H. (Florida State Univ., Tallahassee (USA)). 1981. Contract AS05-78EV05854. 6p. (ORO—5854-4). NTIS, PC A02/MF A01. Order Number DE81028323.

Our working hypothesis is that control of DNA replication resides in certain sequences distributed throughout the genome. We have previously reported that potentially functional origins appear to be distributed at four micron (12 kb) intervals in DNA of Chinese hamster (CHO) cells (Taylor and Hozier, 1976 and Taylor, 1977). Our experimental evidence has not yet allowed us to establish this as a fact, but our experiments and those from other laboratories continue to support the concept and make it worthwhile to continue investigations along this line.

32493 Density gradient fractionation of effector cells in human natural cell-mediated cytotoxicity. Bloom, E.T. (Univ. of Southern California, Los Angeles). Contract 76-S-03-0034. *Cellular Immunology ;* **61**: No. 2, 231-244(1 Jul 1981).

In order to separate and characterize cytotoxic effector cells in natural cell-mediated cytotoxicity (NCMC), human lymphocytes were fractionated by Percoll continuous density gradient centrifugation. Lymphocytes from normal donors were fractionated through a 35-ml gradient and 2- or 3-ml aliquots were collected, counted, and grouped into three or more fractions in order to obtain sufficient cells for testing. Fractions of cells were tested for cytotoxicity in a 4-hr chromium release test and/or a 40 hr [^{3}H] proline assay. Cell markers were assessed by testing for cells forming E rosettes, EA rosettes, and for cells with surface membrane immunoglobulin (SMIg). Results of cytotoxicity tests showed that cells from the top portions of the Percoll gradient had consistently greater cytotoxic activity on a per cell basis than the denser cells sedimenting lower. Estimation of cytotoxic activity in lytic units showed that 54 to 75% of the activity was recovered in the top 26 to 29% of the cells. This approach to investigating cell-mediated cytotoxicity should yield useful information regarding cellular interaction in, and regulation of, cytotoxic activities.

32494 Full-grown oocytes from Xenopus laevis resume growth when placed in culture. Wallace, R.A.; Misulovin, Z.; Etkin, L.D. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Proceedings of the National Academy of Sciences of the United States of America ;* **78**: No. 5, 3078-3082(May 1981).

When most full-grown, follicle cell-invested oocytes from Xenopus laevis are placed in an appropriate culture medium, they resume growth and remain physiologically healthy for at least 2 to 3 weeks. Rates of growth by full-grown oocytes in vitro generally approximate and can even exceed the most rapid growth rate achieved by vitellogenic oocytes in vivo. Resumption of oocyte growth can be correlated with the loss of investing follicle cells, which under normal conditions appear to interfere with vitellogenin and nutrient access to the oocyte. The final size reached by the oocyte within the ovary is thus not an intrinsic property of the oocyte but is extrinsically imposed by the somatic environment.

32495 Flow cytometry: an aid in monitoring lymphocyte transformation in whole blood cultures. Cram, L.S. (Los Alamos Scientific Lab., NM); Forslund, J.C.; Jarnagin, J.L.; Thoen, C.O. *Comparative Immunology, Microbiology and Infectious Diseases ;* **3**: 373-380(1980).

A combination of whole blood cultures, hypotonic fluorescent staining of nucleated cells, and flow cytometry resulted in a greatly improved technique for measuring lymphocyte blastogenesis. Sample preparation was reduced to two steps with no centrifugation. The technique was successfully used to analyze blood cultures derived from experimentally and naturally infected cows. The technique was also shown to be ideally suited for analyzing lymphocytes cultured in whole blood cultures and (1) avoids the problems of tritiated thymidine analysis and (2) provides a direct analysis of the number of cells responding to antigenic stimulation.

32496 Evaluation of the S phase distribution of flow cytometric DNA histograms by autoradiography and computer algorithms. Sheck, L.E.; Muirhead, K.A.; Horan, P.K. (Univ. of Rochester, NY). Contract AC02-76EV03490. *Cytometry (Baltimore) ;* **1**: No. 2, 109-117(1980).

Cell sorting and tritiated thymidine autoradiography were used to define the distribution of S phase cells in flow cytometric DNA histograms obtained from exponential mouse lymphoma cells (L5178Y). The numbers of labeled S phase cells, autoradiographically determined from cells, autoradiographically determined from cells sorted at 2-channel intervals in the G_1/early S and late S/G_2M regions of the histogram, were compared with the numbers of computed S phase cells in comparable 2-channel intervals as predicted by several computer algorithms used to extract cell cycle phase distributions from DNA histograms. Polynomial and multirectangle algorithms gave computed estimates of total %S in close agreement with the tritiated thymidine labeling index for the cell population, while multi-Gaussian algorithms underestimated %S. Interval autoradiographic and algorithm studies confirmed these results in that no significant differences were found between the autoradiographic S phase distribution and S phase distributions calculated by the polynomial and multirectangle models. However, S phase cells were significantly underestimated by G_1/early S by a constrained multi-Gaussian model and in both G_1/early S and late S/G_2 by an unconstrained multi-Gaussian model. For the particular cell line (L5178Y), staining protocol (mithramycin following ethanol fixation) and instrumentation (Coulter TPS-2 cell sorter) used in this study, close agreement between computed %S and tritiated thymidine labeling index was found to be a reliable indicator of an algorithm's success in resolving S phase cells in the G_1/S and S/G_2 transition regions of the DNA histograms.

32497 **Theoretical model for adhesion between cells mediated by multivalent ligands.** Bell, G.I. (Los Alamos Scientific Lab., NM). *Cell Biophysics ;* **1**: 133-147(1979).

A theoretical model is developed for cell-to-cell binding by bivalent ligands that can bind to mobile receptors on the cell surfaces. Monovalent inhibitors that can bind either to receptors or ligands are also included. For symmetrical ligands, it is shown that crosslinking of receptors on each cell will interfere with intercellular bridge formation. At equilibrium, such interference is not drastic, but if the crosslinks can form before the cells are brought into contact, crosslinking may greatly impede the rate of intercellular binding. Comparison is made with experiments, and the importance of receptor mobility is discussed.

5504 Genetics

REFER ALSO TO CITATION(S) 32482

32498 **(BNL—29853) Characterization of mal recombination plasmids cloned in Streptococcus pneumoniae.** Stassi, D.L.; Lopez, P.; Espinosa, M.; Lacks, S.A. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 20p. (CONF-810694—3). NTIS, PC A02/MF A01. Order Number DE81029322.

From 25. Wind River conference on genetic exchange; Estes Park, CO, USA (8 Jun 1981).

The malM locus of Streptococcus pneumoniae was cloned into one of the two PstI sites of the multicopy S. pneumoniae plasmid pMV158. To eliminate chromosomal transformants in the simultaneous selection for tetracycline resistance (coded by pMV158) and maltose utilization, the host cells contained a chromosomal deletion of the mal gene cluster. Two clones were isolated; one with a 3.3 kb insert (pLS70) which behaved like wild type with respect to maltose utilization, and another with a 2.9 kb insert (pLS69) which behaved as though it contained a down promoter mutation. Preliminary mapping of these clones by restriction analysis placed the 0.4kb deletion on a HindIII fragment in the interior of the chromosomal insert. The recombinant plasmids were able to transform over 50% of a recipient population to Mal^+. Enzyme measurements of the clones indicated an overproduction of amylomaltase, constituting up to 10% of the total cellular protein, and supported the theory that the deletion in the pLS69 is in the promoter region. Protein analysis by polyacrylamide gel electrophoresis confirmed that the amylomaltase polypeptide was produced in large amounts in induced cells containing the pLS70. Another polypeptide, possibly a fragment of the phosphorylase or X protein of the mal gene cluster, was also produced to a similar extent.

32499 **(DOE/EV/10566—1) Mechanisms of mutagenesis: analysis through the use of alcohol dehydrogenase in Drosophila. Progress report, November 1, 1980-October 31, 1981.** Sofer, W. (Rutgers--the State Univ., Piscataway, NJ (USA). Waksman Inst. of Microbiology). Jun 1981. Contract AC02-81EV10566. 4p. NTIS, PC A02/MF A01. Order Number DE81029032.

Research to deduce the mechanism of action of mutagens in higher organisms was conducted. Our approach was to generate mutations at a well-defined locus (alcohol dehydrogenase) in Drosophila melanogaster and to determine which amino acids were changed by the mutagenic event. Using a combination of nucleic acid and peptide sequencing, which bases have been modified, how adjoining bases affect the frequency and quality of mutagenesis, and how the proteins associated with the DNA affect mutagenesis are being determined. (ERB)

32500 **Isolation of MMS- and histidine-sensitive mutants in Neurospora crassa.** Delange, A.M.; Mishra, N.C. (Univ. of South Carolina, Columbia). Contract EP-78-S-09-1071. *Genetics ;* **97**: No. 2, 247-259(Feb 1981).

A simple method of replica plating has been used to isolate mutants of Neurospora crassa that have increased sensitivity to methyl methanesulfonate (MMS) and/or to histidine. Twelve mutants with increased sensitivity to MMS and one mutant with increased sensitivity to histidine showed Mendelian segregation of the mutant phenotypes. Three mutants were mapped to loci not previously associated with MMS sensitivity. Two others were allelic to the uv- and MMS-sensitive mutant, mei-3. Survival curves indicate that conidia (mutant or wild-type) survive on much higher concentrations of MMS at 25° than at 37°. In contrast, mycelial growth is more resistant to MMS at 37°. The possibility of qualitatively different repair processes at these two temperatures is discussed.

32501 **Analysis of pleiotropism at the dominant white-spotting (W) locus of the house mouse: a description of ten new W alleles.** Geissler, E.N.; McFarland, E.C.; Russell, E.S. (Jackson Lab., Bar Harbor, ME). Contract EY-3264. *Genetics ;* **97**: No. 2, 337-361(Feb 1981).

Characterization of the pleiotropic effects of ten new putative W locus mutations, nine co-isogenic and one highly cogenic with the C57BL/6J strain, reveals a wide variety of influences upon pigmentation, blood formation and gametogenesis. None of the putative alleles, each of which is closely linked to Ph, a gene 0.1 cM from W, gave evidence of complementation with W^{39}, a new allele previously shown to be allelic to W/sup v/. All W^{*}/W^{39} genotypes resulted in black-eyed-white anemics with reduced gametogenic activity. Homozygotes for seven of these mutations are lethal during perinatal life; anemic embryos for seven of these mutations are lethal during perinatal life; anemic embryos have been identified in litters produced by intercross matings involving each of these alleles. Phenotypes of mice of several mutant genotypes provide exceptions to the frequent observation that a double dose of dominant W alleles (e.g., W/W/sup v/ or W/W) results in defects of corresponding severity in each of the three affected tissues. One viable homozygote has little or no defect in blood formation, and another appears to have normal fertility. The phenotypes of these homozygotes support the conclusion that the three tissue defects are not dependent on each other for their appearance and probably do not result from a single physiological disturbance during the development of the embryo. Although homozygosity for members of this series results in a wide range of phenotypes, the absence of complementation of any allele with W^{39}, the close proximity of each mutant to Ph, and the fact that all alleles produce detectable (though sometimes marginal) defects in the same tissues affected by W and W/sup v/, support the hypothesis that each new mutant gene is a W allele.

5505 Metabolism

REFER ALSO TO CITATION(S) 32552

5506 Medicine

32502 **(BNL—29958) Intercomparison of techniques for the non-invasive measurement of bone mass.** Cohn, S.H. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 14p. NTIS, PC A02/MF A01. Order Number DE81029921.

A variety of methods are presently available for the non-invasive measurement of bone mass of both normal individuals and patients with metabolic disorders. Chief among these methods are radiographic techniques such as radiogrammetry, photon absorptiometry, computer tomography, Compton scattering and neutron activation analysis. In this review, the salient features of the bone measurement techniques are discussed along with their accuracy and precision. The advantages and disadvantages of the various techniques for measuring bone mass are summarized. Where possible, intercomparisons are made of the various techniques.

32503 **(BNL—29959) Applications of nuclear techniques for in vivo body composition studies at Brookhaven National Laboratory.** Cohn, S.H.; Ellis, K.J.; Vartsky, D.; Vaswani, A.N.; Wielopolski, L. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 42p. (CONF-8106151—1). NTIS, PC A03/MF A01. Order Number DE81029922.

From IAEA conference on nuclear based techniques for in vivo study of human body composition; Upton, NY, USA (22 Jun 1981).

A series of technical developments and their clinical applications in various nuclear technologies at Brookhaven National Labo-

ratory is described. These include the development of a portable neutron activation facility for measuring cadmium in vivo in kidney and liver, a technique for the measurement of body iron utilizing nuclear resonant scattering of gamma rays, a non-invasive measure of the skeletal levels of lead by an x-ray fluorescence technique, and the development of a pulsed Van de Graaff generator as a source of pulsed neutrons for the measurement of lung silicon. (ACR)

32504 **(DOE/EV/10360—2) Correlation of chromosome patterns in human leukemic cells with exposure to chemicals and/or radiation. Progress report, January 1, 1981-December 31, 1981.** Rowley, J.D. (Chicago Univ., IL (USA)). Aug 1981. Contract AC02-80EV10360. 11p. NTIS, PC A02/MF A01. Order Number DE81028158.

The overall aim is to determine whether there is a relationship between exposure to radiation, environmental pollutants, and/or genetic background and the development of ANLL or other hematologic malignancies. I will try to define the factors that influence the development of ANLL as a second malignancy in patients who have been exposed to large doses of radiotherapy and/or chemotherapeutic agents. Two long-term goals are (1) to identify the genes that are located at the sites of consistent translocations, and then to determine the alterations in gene function that are associated with these translocations and (2) to establish the baseline frequency of various chromosome changes (mutations) in myeloid cells and then to analyze the influence of various types of environmental exposure or medical treatment on this baseline mutation rate. Ultimately, it may be possible to determine the extent of mutagenic exposure in various populations through an analysis of the leukemic cells of that populations.

32505 **(HRP—0902605/5) Criteria and standards for radiation therapy (megavoltage) in southeastern Michigan.** (Comprehensive Health Planning Council of Southeastern Michigan, Inc., Detroit (USA)). 21 Nov 1979. 60p. NTIS, PC A04/MF A01.

The criteria and standards presented in this document provide the basis for the review of proposals to establish, expand or alter institutionally-based radiation therapy services, the criteria developed should provide sufficient guidance to the Plan Implementation Committee of CHPC-SEM to enable it to accomplish the following: Assure the existence of sufficient treatment capacity to serve the identified radiation therapy needs of the Southeastern Michigan community; Assure the residents of Southeastern Michigan of reasonable access to radiation therapy services; Assure that the radiation therapy services offered are of good quality; Avoid unnecessary and wasteful duplication of radiation therapy equipment and services; and promote the effective operation of the health care system in Southeastern Michigan. These criteria and standards also should provide guidance to providers who may consider initiating a new radiation therapy service or altering an existing service or program.

32506 **^{67}Ga scanning in talc-induced pulmonary granulomatosis.** Brown, D.G.; Aguirre, A.; Weaver, A. (Riverside Methodist Hospital, Columbus, OH). *Chest ;* **77**: No. 4, 561-565(Apr 1980).

We describe a case of pulmonary granulomatosis in a user who habitually injected methylphenidate (Ritalin) intravenously; symptomatic and objective improvement occurred with corticosteroid therapy. A scan of the lungs using raioactive ^{67}Ga showed an increased concentration of ^{67}Ga throughout both lungs. There was a reduction in abnormal accumulation of ^{67}Ga, improvement in the arterial oxygen pressure and the diffusing capacity for carbon monoxide, and a reduction in the infiltrate on the chest x-ray film two months after the institution of therapy. Before treatment the patient's symptoms and arterial deoxygenation increased despite the cessation of her drug abuse, thus raising the question of a self-perpetuating inflammatory process in a case of pulmonary deposition of talc.

32507 **Radioimmunodetection of colorectal cancer.** Kim, E.E.; Deland, F.H.; Casper, S.; Corgan, R.L.; Primus, F.J.; Goldenberg, D.M. (Univ. of Kentucky, Lexington). *Cancer ;* **45**: No. 5, 1243-1247(15 Mar 1980).

This study examines the accuracy of colorectal cancer radioimmunodetection. Twenty-seven patients with a history of histologically-confirmed colonic or rectal carcinoma received a high-titer, purified goat anti-CEA IgG labelled with ^{131}I at a total dose of at least 1.0 μCi. Various body views were scanned at 24 and 48 hours after administration of the radioantibody. Three additional cases were evaluated; one had a villous adenoma in the rectum and received the ^{131}I-labeled anti-CEA IgG, while two colonic carcinoma patients received normal goat IgG labelled with ^{131}I. All of the 7 cases with primary colorectal cancer showed true-positive tumor localization, while 20 of 25 sites of metastatic colorectal cancer detected by immune scintigraphy were corroborated by other detection measures. The sensitivity of the radioimmunodetection of colorectal cancers (primary and metastatic) was found to be 90% (true-positive rate), the putative specificity (true-negative rate) was 94%, and the apparent overall accuracy of the technique was 93%. Neither the case of a villous adenoma receiving the anti-CEA IgG nor the two cases of colonic cancer receiving normal goat IgG showed tumor radiolocalization. Very high circulating CEA titers did not appear to hinder successful tumor radiolocalization. These findings suggest that in colorectal cancers the method of CEA radioimmunodetection may be of value in preoperatively determining the location and extent of disease, in assessing possible recurrence or spread postoperatively, and in localizing the source of CEA production in patients with rising or elevated CEA titers. An ancilliary benefit could be a more tumor-specific detection test for confirming the findings of other, more conventional diagnostic measures.

32508 **Elimination of acute muelogenous leukemic cells from marrow and tumor suspensions in the rat with 4-hydroperoxycyclophosphamide.** Sharkis, S.J.; Santos, G.W.; Colvin, M. (Johns Hopkins Univ., Baltimore, MD). *Blood ;* **55**: No. 3, 521-523(Mar 1980).

Cell suspensions of normal rat marrow mixed with rat acute myelogenous leukemic cells were prepared and incubated in vitro with graded doses of 4-hydroperoxycyclophosphamide (4HC). The cell suspensions were injected into rats prepared with a lethal dose of total body irradiation. Animals injected with these cells survived fatal irradiation induced aplasia. In a dose related manner 4HC was able to purge tumor cells from the cell mixtures. Thus, animals given cell suspensions incubated with the lower doses of 4HC showed prolonged survived before death from leukemia and animals given cell suspensions incubated with higher doses of 4HC survival lethal irradiation without the subsequent appearance of leukemia. These studies clearly establish that tumor cells may be eliminated from normal marrow suspensions without completely destroying the pluripotent stem cells.

32509 **Radiotherapy for Kaposi's sarcoma.** Lo, T.C.; Salzman, F.A.; Smedal, M.I.; Wright, K.A. (Lahey Clinic Foundation, Boston, MA). *Cancer ;* **45**: No. 4, 684-687(15 Feb 1980).

Between 1954 and 1976, 60 patients with Kaposi's sarcoma were treated in the Department of Radiotherapy of the Lahey Clinic Foundation at the High Voltage Research Laboratory of Massachusetts Institute of Technology. Only 2 patients were free of clinical disease in the lower extremities at the time of initial presentation, and 40 patients (69%) had cutaneous lesions involving areas extending above the knees. Eight patients (13%) also presented with mucous membrane involvement in addition to skin disease. Twenty-one patients were treated only with megavoltage electrons during the initial course of radiotherapy, and 12 patients were treated with supervoltage photons alone. The remaining 27 patients were treated with a combination of electrons and photons; in 17 patients, the same tumor sites were irradiated with both modalities. Eleven patients received whole-body surface electron irradiation. The choice of treatment modalities was based on the extent and distribution of cutaneous disease and depth of the lesions. The overall response rate was 93% after a single fractionated course of radiotherapy. Twenty-five patients achieved complete regression and 18 were in remission for 2 to 13 years. Response rates were also analyzed with respect to the three subgroups in terms of treatment modalities. A single dose of 800 to 1200 rads or its equivalent was required to control local cutaneous lesions. Widespread visceral metastasis was the most common cause of failure and death; the incidence of second malignancies was increased. Trial of systemic che-

motherapy and immunotherapy would seem to be a reasonable therapeutic adjunct.

32510 **Improvements in the radiotherapy of medulloblastoma, 1946 to 1975.** Landberg, T.G.; Lindgren, M.L.; Cavallin-Staehl, E.K.; Svahn-Taper, G.O.; Sundbaerg, G.;Garwicz, S.; Lagergren, J.A.; Gunnesson, V.L.; Brun, A.E.; Cronqvist, S.E. (Univ. Hospital, Lund, Sweden). *Cancer ;* **45**: No. 4, 670-678(Feb 1980).

The prognosis in medulloblastoma has often been reported to be gloomy, and five-year survival rates of approximately 25% are often reported. In recent years, however, some centers have published results that indicate a possible cure rate of 60% or even more. During the years 1946 to 1975, 50 children received radiotherapy for medulloblastoma at the University Hospital, Lund, Sweden. During this period the target volume had been defined in three different ways, whereas the target-absorbed doses had not differed. When only the demonstrated tumor was treated, the ten-year survival rate was 5%. If the spinal subdural space also was included, it rose to 25%, and when the whole subdural space was treated in addition to the demonstrated tumor, the projected ten-year survival rate was 53%. It is apparent that the target volume in the radiotherapy of medulloblastoma should include not only the demonstrated tumor but also the whole subdural space from the tip of the frontal lobes down to and including the second sacral segment. The size of the target-absorbed dose to be aimed at is not settled, but should consider not only the cure rate but also the performance status of the survivors. It seems from the present series that an absorbed dose of 45 Gy in not more than 30 fractions over six weeks to the demonstrated tumor and 30 Gy in 20 fractions over four weeks to the subdural space resulted in a fair frequency of tumor healing and minimal side effects. The delivery of this complicated treatment demands a high degree of precision in the technique. In this material the performance status of the children was not affected by the radiation treatment.

5507 Microbiology

REFER ALSO TO CITATION(S) 31811, 32482, 32483, 32492, 32552

32511 **(DOE/ER/10703—1) Investigation of the molecular mechanism of thermal tolerance in bacillus subtilis. Final report, August 15, 1980-August 14, 1981.** Yamamoto, N.; Alexander, J.; Ch'ih, J. (Hahnemann Medical Coll. and Hospital, Philadelphia, PA (USA)). 14 Aug 1981. Contract AC02-80ER10703. 14p. NTIS, PC A02/MF A01. Order Number DE81027958.

We have studied Bacillus subtilis, Bacillus pumilus and Bacillus caldolyticus to ascertain the molecular mechanism of the ability to growth at high temperatures. B. subtilus wild type strains grow in minimal salts medium at a mesophilic temperature (37°C) but not at a thermophilic temperature (56°C). However, they do grow at 56°C in complex rich media. Analysis of their nutritional requirements revealed that these bacteria require pyridoxine or aspartic acid and threonine to grow at 56°C indicating that they are temperature sensitive mutants. Furthermore, mutants of B. subtilis which are able to grow on minimal salts media at 56°C can be readily isolated. Therefore, it appears that the lack of growth of the wild type strain in minimal salts media at 56°C is due to the instability of an anabolic enzyme. In contrast to B. subtilis, B. pumilus has never been observed to growth above 50°C. However, our studies show that mutants of B. pumilus and B. subtilis which grow at 68°C can be easily isolated. The isolation of such mutants strongly supports the idea that one gene can determine the ability to grow at extreme temperatures.

32512 **Effect of manual brush cleaning on biomass and community structure of microfouling film formed on aluminum and titanium surfaces exposed to rapidly flowing seawater.** Nickels, J.S. (Florida State Univ., Tallahassee); Bobbie, R.J.; Lott, D.F.; Martz, R.F.; Benson, P.H.; White, D.C. Contract W-31-109-ENG-38. *Applied and Environmental Microbiology ;* **41**: No. 6, 1442-1453(Jun 1981).

Metals exposed to rapidly flowing seawater are fouled by microbes that increase heat transfer resistance. In this study, results of biochemical test methods quantitatively relating the biomass and community structure of the microfouling film on aluminum and titanium to heat transfer resistance across the metal surface during three cycles of free fouling and manual brushing showed that cleaning accelerates the rate of fouling measured as the loss of heat transfer efficiency and as microfouling film biomass. The results also showed that the rate of fouling, measured as an increase in heat transfer resistance, is faster on titanium than on aluminum but that the titanium surface is more readily cleaned. In three cycles of free fouling and cleaning with a stiff-bristle nylon brush, the free-fouling communities re-forming on aluminum became enriched in bacteria containing short-branched fatty acids as the cycling progressed. The free-fouling community on titanium revealed an increasingly diverse morphology under scanning electron microscopy that was enriched in a portion of the microeucaryotes.

5508 Morphology

REFER ALSO TO CITATION(S) 32532

5509 Pathology

REFER ALSO TO CITATION(S) 32560

5510 Physiological Systems

REFER ALSO TO CITATION(S) 32494, 32558, 32561, 32562, 32565, 32569, 32570, 32571, 32573, 32574, 32575, 32576, 32577, 32578, 32579, 32580

5520 Public Health

REFER ALSO TO CITATION(S) 32572, 32576, 32581, 32582

32513 (EPA/600/9—81-001, pp 358-367) **Overview of research and regulatory activities of the California Air Resources Board.** Holmes, J.R. (California Air Resources Board, Sacramento). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

The research programs and regulatory functions of the Air Resources Board of California are surveyed. Included are discussions of effects of air pollution, economic impacts of air pollution control, emissions inventory and control technology, atmospheric processes, air quality monitoring, meteorological forecasting, and measurement methods. (DLS)

32514 **Population characteristics and environmental factors that influence level and cause of mortality: a review.** Curtiss, J.R.B.; Grahn, D. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Journal of Environmental Pathology and Toxicology ;* **4-2,3**: 471-511(1980).

A quantitative tabulation of relationships represents an original attempt to quantitatively summarize most of the known relationships between mortality (total and cause-specific and its influencing factors. In those cases where mathematical relationships were not directly available in the literature, they were derived from published data using computer generated orthogonal polynomials. The t-test was then applied to determine the appropriate form of the relationship (linear, second degree, third degree, etc.) and its significance. For each equation derived specifically for this reivew there is a measure of mortality (rate or ratio), the coefficients, their errors and the units by which the independent variable is measured. Intercepts are not given as they are dependent on the characteristics of the population under examination. The purpose of the table is to estimate the amount of change in the mortality component per unit change in the independent variable and to see if a consistent relationship appears regardless of the intercept.

5530 Agriculture And Food Technology

32515 (MIT-EL—79-048) Center pivot irrigation in Nebraska: an institutional analysis case study. Nutt-Powell, T.E.; Landers, S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Dec 1979. Contract AM01-76EI02295. 56p. NTIS, PC A04/MF A01. Order Number DE81029709.

The results of a study of institutional factors influencing acceptance of center-pivot irrigation in the Nebraska agricultural community are reported. Center-pivot irrigation (CP) was an interesting topic for study because (1) it was a major recently introduced technological innovation in agriculture which (2) had potentially detrimental attributes - water and energy intensity. A brief historical review of the introduction and acceptance of center-pivot irrigation in the Nebraska agricultural community is presented. Institutions which were a likely part of this institutional arena relative to CP introduction and acceptance were identified. Their likely responses were hypothesized, then data collected regarding actual response. Three broad conclusions are drawn: (1) there were definite institutional influences in the acceptance of CP in the Nebraska agricultural community; (2) acceptance was facilitated in the Nebraska agricultural community because the innovation differentiation process yielded secondary attributes of CP that met prevailing social orders; and (3) the innovation differentiation process for CP in the Nebraska agricultural community yielded both transformation and disconnection of detrimental attributes, creating the circumstances for attribute redefinition in the first instance and another innovation in the second instance.

32516 (PB—81-104531) Abstracts of urban forestry research in progress - 1979. General technical report (final). Rowntree, R.A.; Wolfe, J.L. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). Sep 1980. 80p. NTIS, PC A05/MF A01.

The report is a summary of research in progress on urban forestry. Abstracts inform researchers of ongoing work and help urban forest managers anticipate results of interest to them.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 31753, 31754, 32444, 32479, 32479, 32481, 32504, 32510

32517 (ANL—80-115-Part2) Radiological and Environmental Research Division annual report, July 1979-June 1980. Rowland, R.E.; Stehney, A.F. (Argonne National Lab., IL (USA)). May 1981. Contract W-31-109-ENG-38. 274p. NTIS, PC A12/MF A01. Order Number DE81027452.

Separate abstracts were prepared for 19 of the 33 papers presented by the Center for Human Radiobiology for the Radiological and Environmental Research Division Annual Report. The 14 items not included are abstracts only and deal with the mechanisms and dosimetry for induction of malignancies by radium. (KRM)

32518 (ANL—80-115-Part2, pp 1-21) **Dosimetry of paranasal sinus and mastoid epithelia in radium-exposed humans.** Schlenker, R.A. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Dose calculations for ^{228}Ra and ^{226}Ra are presented for the sinus and mastoid epithelia and lead to the conclusion that the isotopes are of comparable dosimetric significance for the production of carcinomas in patients exposed to comparable levels.

32519 (ANL—80-115-Part2, pp 29-32) **Radiation dose to the cells at risk for the induction of bone tumors by bone-seeking radioisotopes.** Lloyd, E.L. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

For bone-seeking radioactive isotopes, such as ^{226}Ra, ^{224}Ra, and ^{239}Pu, it has become common practice to consider a layer of cells 0 to 10 microns from bone mineral as appropriate for calculations of effective carcinogenic radiation doses. From considerations of our measurements of dimensions and positions of cells relative to bone mineral at the endosteal surface of human bone together with our in vitro studies, it would appear that limitation to less than the complete range of the emitted particles is unwarranted for calculation of the dose.

32520 (ANL—80-115-Part2, pp 33-40) **Survival of human osteosarcoma cells and normal human fibroblasts following alpha particle irradiation.** Lloyd, E.L.; Gemmell, M.A. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Cell survival of human osteosarcoma cells in culture following alpha particle irradiation is reported here for the first time. The osteosarcoma cell line (TE-85) is found to be less sensitive to inactivation by 5.6 MeV alpha particles (LET 86 keV/μm) than normal diploid human fibroblasts (NFS). Values for the mean lethal doses were estimated to be 103 rads for the TE-85 cells compared with 68 rads for the NFS cultures irradiated under identical conditions. It is postulated that the aneuploidy of the tumor cells with increased DNA chromosomal material may confer a selective advantage for the survival of tumor cells relative to normal cells with diploid chromosomes.

32521 (ANL—80-115-Part2, pp 53-60) **Mitogenic responses of normal human lymphocytes incubated with sera from radium workers.** Serio, C.S.; Henning, C.B.; Toohey, R.E.; Lloyd, E.L. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Sera from radium workers were incubated with normal human lymphocytes and compared with sera from normal age-matched controls for its effect on lymphocyte stimulation with different mitogens. The results obtained with sera from the radium workers with high residual body burdens (>0.1 μCi ^{226}Ra) were shown to inhibit stimulation following treatment with conconavalin A (Con A) but not with phytohemagglutinin (PHA) nor pokeweed mitogen (PWN).

32522 (ANL—80-115-Part2, pp 61-62) **Concept of dose, dose-rate, and specific energy.** Marshall, J.H. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

In analyzing the results of experiments, it is essential to separate theory and experiment. This separation is most secure when one uses parameters that have been defined operationally. An operational parameter is based solely on numerical readings taken in the course of that measurement. Parameters which invoke, for their calculation, the results of other experiments or assumptions based on other experiments, are not operational.

32523 (ANL—80-115-Part2, pp 64-68) **Coding, storage, and retrieval of medical information: experience with the standard nomenclature of pathology (SNOP).** Brues, A.M. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Pathological conditions indicated in the records of all radium cases in CHR are coded according to the SNOP classification and filed in computer memory for future reference and intercorrelations with other individual data. Records of about 3700 located cases have yielded a total of about 150,000 entries. The use of this data base in epidemiologic studies is discussed, including problems related to the heterogeneous sources of data.

32524 (ANL—80-115-Part2, pp 69-71) **Health status and body radioactivity of former thorium workers.** Stehney, A.F.; Polednak, A.P.; Rundo, J.; Brues, A.M.; Lucas, H.F. Jr.; Patten, B.C.; Rowland, R.E. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

The objectives of the study are: (1) to assess possible health effects of employment in the thorium milling industry by comparison of mortality and morbidity characteristics of former thorium workers with those of suitable general populations; (2) to examine disease outcomes by estimated exposure levels of thorium and thoron daughter products for possible radiation-related effects; and (3) to determine the body distribution of inhaled thorium (and daughters) and rare earths in humans by radioactivity measurements in vivo and by analysis of autopsy samples. The principal end points for investigation are respiratory disease and cancers of lung, liver, bone, and bone marrow.

32525 (ANL—80-115-Part2, pp 74-88) **Estimation of exposure to ^{222}Rn from the excretion rates of $^{21}\pi$Pb.** Holtzman, R.B.; Rundo, J. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

A model is proposed with which estimates of exposure to ^{227}Rn and its daughter products may be made from urinary excretion rates of ^{210}Pb. It is assumed that 20% of all the ^{210}Pb inhaled reaches the blood and that 50% of the endogenous excretion is through the urine. The estimates from the model are compared with the results of measurements on a subject residing in a house with high levels of radon. Whole body radioactivity and excretion data were consistent with the model, but the estimates of exposure (WL) were higher than those measured with an Environmental Working Level Monitor.

32526 (ANL—80-115-Part2, pp 89-96) **Excretion of ^{210}Pb and ^{210}Po by workers in an area with high levels of atmospheric radon, and estimates of exposure to short-lived radon daughters.** Holtzman, R.B.; Urnezis, P.W.; Rundo, J. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

The urinary excretion rates of ^{210}Pb were used to estimate the exposure to ^{222}Rn and its short-lived daughter-products for 12 persons who worked at an industrial site formerly used for the processing of uranium ores. The geometric mean excretion rates of ^{210}Pb and ^{210}Po of 0.86 and 1.93 pCi/day were significantly above normal environmental levels. The mean value of the available ^{210}Pb (that in the soft tissue) was estimated from the excretion rates of ^{210}Po to be about 2.6 nCi. The geometric mean lung exposure derived from the ^{210}Pb excretion rates was estimated at 0.41 WL based on a conversion factor of 1.49 pCi day^{-1} WL^{-1}. This mean did not agree with the mean value of 0.14 WL that had been estimated from radon decay products in the atmosphere of the building.

32527 (ANL—80-115-Part2, pp 106-107) **Uranium concentrations in human bone.** Schlenker, R.A.; Oltman, B.G. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

The natural uranium content in the bone of one person has been determined by a new method. The results were obtained by quantitative analysis of fission track autoradiographs of bone from a person injected witn ^{239}Pu.

32528 (ANL—80-115-Part2, pp 109-118) **Measurements of radioactivity in former military personnel exposed to weapon debris.** Toohey, R.E.; Rundo, J.; Essling, M.A.; Sha, J.Y.; Oldham, R.D.; Sedlet, J.; Robinson, J.J. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Sixteen former military personnel who were present at the Smoky atmospheric nuclear weapons test have been investigated for internal deposits of radioactivity. Whole-body and thorax γ-ray measurements, thorax and skeletal actinide measurements, and urinalyses for ^{239}Pu and ^{90}Sr were performed. No evidence of radioactivity in excess of that found in the general population was observed.

32529 (ANL—80-115-Part2, pp 124-128) **Continued studies of the gastrointestinal absorption of plutonium by rodents.** Larsen, R.P.; Oldham, R.D.; Bhattacharyya, M.H.; Moretti, E.S. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

An investigation is being made of the absorption of plutonium from the gastrointestinal tract of rodents. In the mouse it has been found to be essentially independent of the oxidation state of plutonium and the administration medium. In the rat the absorption was higher than it was in the mouse, but not appreciably so. The values obtained for both mice and rats are about two orders of magnitude higher than the value adopted for the gastrointestinal absorption factor for plutonium in man.

32530 (ANL—80-115-Part2, pp 129-134) **Gastrointestinal absorption of plutonium in the dog.** Toohey, R.E.; Bhattacharyya, M.H.; Oldham, R.D.; Larsen, R.P.; Moretti, E.S. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

The gastrointestinal absorption of plutonium in the beagle has been determined to be 0.066 +- 0.014% of the amount administered. This result is quite comparable with the results reported for the dog by other workers, and a factor of 3 smaller than that observed by us for mice. On the average, the retained plutonium was found to be almost equally divided between the liver and the skeleton.

32531 (ANL—80-115-Part2, pp 135-137) **Energy dependence of the effective soft tissue thickness.** Toohey, R.E. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

The concept of effective soft tissue thickness (ESTT) was proposed as a method for the calibration of lung counting systems for the detection of plutonium in vivo. Since the definition of ESTT was based on experiments following the inhalation of ^{103}Pd, which emits 20.2- and 22-keV x rays, there is a question about the applicability of ESTT to plutonium, whose principal x-ray emission is at 17 keV. Thus, the energy dependence of ESTT was investigated.

32532 (ANL—80-115-Part2, pp 139-148) **Identification through osteometric data on three radium-burdened skeletons.** Farnham, J.E.; Forkal, J.W. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

The skeletal remains of four persons of uncertain identity were disinterred from a family grave. The weight and description morphological traits of each bone were recorded, as were the lengths of the long bones. Analyses of these data, combined with information obtained from medical records and disinterment reports, led to the specific identification of each skeleton.

32533 (ANL—80-115-Part2, pp 149-183) **Osteometry of the skeletons of 101 human radium cases.** Farnham, J.E.; Forkal, J.W. May 1981. NTIS, PC A12/MF A01.

In Radiological and Environmental Research Division annual report, July 1979-June 1980.

Osteometry has been performed on the skeletal remains of 101 persons in the radium studies population. The measured values for lengths and weights of various bones are reported, and values for the estimated total skeletal weight and height are calculated. Further, the data have been normalized to a dry, fat-free skeleton and the estimated total skeletal weight recalculated. The mean values reported did not differ significantly between this study group and normal values reported in the literature. These findings indicate no detectable effect of large skeletal doses of radiation on the stature or total skeletal weight of these individuals.

32534 (DOE/EV/02364—T2) Mechanisms for radiation damage in DNA. Progress report, January 1, 1981-December 31, 1981. Sevilla, M.D. (Oakland Univ., Rochester, MI (USA)). Sep 1981. Contract AS02-76EV02364. 10p. (COO—2364-19). NTIS, PC A02/MF A01. Order Number DE81026637.

Several mechanisms for radiation damage to DNA constituents and DNA are proposed, and a series of experiments utilizing electron spin resonance spectrometry to test the proposed mechanisms is detailed. Past experiments have concentrated chiefly on the direct affect of radiation on DNA. Currently irradiated systems on DNA constituents are being investigated to shed light on indirect effects. In addition, studies of radiation effects on lipids were undertaken which will shed light on the only other proposed site for cell kill, the membrane. Studies which were completed or progressed during the past year include: (1) study of the oxidation radicals in azauracil and azathymine: a case for both σ and π radicals; (2) studies of the π-cation radicals of the 5-halouracils; (3) hydrogen abstraction reactions by the peptide bond protonated anion: a comparison to acid, ester, aldehyde, and ketone protonated anions; (4) internal hydrogen bonding in the π-cations of hydroxymethyluracil and hydroxymethyl-cytosine; and (5) study of radicals generated in model compounds for the sugar-phosphate backbone.

32535 (DOE/EV/04733—T1, pp 262-273) Tumor promotor TPA as a radioprotector against cell killing in C3H/10T 1/2 mouse embryo cells. Geard, C.R.; Rutledge-Freeman, M. Jul 1981. NTIS, PC A14/MF A01.

In Radiation physics, biophysics and radiation biology. Progress report, October 1, 1980-September 30, 1981.

In the course of studies examining the effects of TPA (12-0-tetradecanoyl-phorbol-13-acetate) on radiation induced transformation in mouse C3H/10T 1/2 cells it was noted that there was a consistent though small enhancement of cell survival after the single doses of radiation used. These studies were designed to examine the validity of this effect and to ascertain the mechanisms of action. Further, the earlier study showed that TPA (1 concentration) had little positive influence on sister chromatid exchange induction. Since the promotional activity of TPA had been proposed to act via enhanced somatic recombination as shown by increased SCE's it was considered desirable to assess the effects of additional concentrations of TPA.

32536 Comparative study of x-ray and uv induced cytotoxicity, DNA repair, and mutagenesis in Down's syndrome and normal fibroblasts. Yotti, L.P.; Glover, T.W.; Trosko, J.E.; Segal, D.J. (Michigan State Univ., East Lansing). *Pediatric Research ;* **14**: No. 2, 88-92(Feb 1980).

Utilizing six age-matched human fibroblast cell strains (three normal and three Down's syndrome) cytotoxicity, DNA repair, and x-ray mutagenesis were measured. There was no significant difference in the colony-forming ability after ultraviolet (uv) or x-irradiation between normal and Down's fibroblasts. Similarly, uv-induced unscheduled DNA synthesis was not significantly different between normal and Down's cells. Finally, a comparison between the spontaneous and x-ray induced mutation frequency at the hypoxanthine-guanine phosphoribosyl transferase locus demonstrated no difference between the two cell types (normal and Down's).

32537 (INIS-mf—6068) Reparative and compensatory processes in case of radiation injuries. Summaries of reports. (Tsentral'nyj Nauchno-Issledovatel'skij Rentgeno-Radiologicheskij Inst., Leningrad (USSR)). 1979. 187p. (In Russian). (CONF-7911151—(Summ)). NTIS, PC A09/MF A01.

From 7. all-union scientist conference on reparative and compensatory processes in case of radiation injuries; Leningrad, USSR (21 Nov 1979).

Items within the scope of EDB have been entered individually in the data base. (ACR)

32538 (PNL-SA—9522) Therapy for incorporated radionuclides: scope and need. Smith, V.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 11p. (CONF-791077—9). NTIS, PC A02/MF A01. Order Number DE81028023.

From Workshop on measurement and interpretation of actinide accumulation by man; Snowbird, UT, USA (14 Oct 1979).

In the United States the recent termination of funding for research on therapy for incorporated radionuclides has virtually halted progress on improved or new agents and procedures for removing radioactivity from the body. Research was eliminated, but is still needed on new removal agents, improved delivery system, in vitro test systems, and the toxicology of treatments. For many radionuclides, no adequate therapy exists. The relationship between radionuclide removal and reduction in cancer risk is still unanswered. Without proper research support, needed improvements in the treatment for incorporated radionuclides in the US are uncertain.

32539 (SAND—81-0427, pp 143-152) Biology task group. Jul 1981. NTIS, PC A10/MF A01.

From 6. annual NEA-seabed working group meeting; Paris, France (2 Feb 1981).

The accomplishments of the task group studies over the past year are reviewed. The purposes of biological investigations, in the context of subseabed disposal, are: an evaluation of the dose to man; an estimation of effects on the ecosystem; and an estimation of the influence of organisms on and as barriers to radionuclide migration. To accomplish these ends, the task group adopted the following research goals: (1) acquire more data on biological accumulation of specific radionuclides, such as those of Tc, Np, Ra, and Sr; (2) acquire more data on transfer coefficients from sediment to organism; (3) Calculate mass transfer rates, construct simple models using them, and estimate collective dose commitment; (4) Identify specific pathways or transfer routes, determine the rates of transfer, and make dose limit calculations with simple models; (5) Calculate dose rates to and estimate irradiation effects on the biota as a result of waste emplacement, by reference to background irradiation calculations. (6) Examine the effect of the biota on altering sediment/water radionuclide exchange; (7) Consider the biological data required to address different accident scenarios; (8) Continue to provide the basic biological information for all of the above, and ensure that the system analysis model is based on the most realistic and up-to-date concepts of marine biologists; and (9) Ensure by way of free exchange of information that the data used in any model are the best currently available.

32540 (UCRL—53156) Characterization of muntjac DNA. Davis, R.C. (Lawrence Livermore National Lab., CA (USA)). 27 May 1981. Contract W-7405-ENG-48. 196p. NTIS, PC A09/MF A01. Order Number DE81029865.

Sister chromatid exchange (SCE) in muntjac chromosomes is generally proportional to the chromosomal DNA content, but the SCE frequency is reduced in the heterochromatic neck region of the X chromosome. The physical properties of muntjac DNA and the kinetics of repair of UV damage in muntjac heterochromatin and euchromatin were examined and compared with the distribution of sister chromatid exchange.

32541 Comparative effects of ^{60}Co γ-rays and neon and helium ions on cycle duration and division probability of EMT 6 cells. A time-lapse cinematography study. Collyn-d'Hooghe, M. (Institut National de la Sante et de la Recherche Medicale (INSERM), Inst. de Recherche sur le Cancer, Lille (France)); Hemon, D. (Unite de Recherches Epidemiologiques et Statistiques sur l'Environnement et la Sante, Villejuif (France)); Gilet, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale); Curtis, S.B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Valleron, A.J.; Malaise, E.P. (Institut Gustave Roussy, 94 - Villejuif (France)). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine ;* **39**: No. 3, 297-306(Mar 1981).

Exponentially growing cultures of EMT 6 cells were irradiated in vitro with neon ions, helium ions or ^{60}Co γ-rays. Time-lapse cinematography allowed the determination, for individual cells, of cycle duration, success of the mitotic division and the age of the cell at the moment of irradiation. Irradiation induced a significant mitotic delay increasing proportionally with the delivered dose. Using mitotic delay as an endpoint, the r.b.e. for neon ions with respect to ^{60}Co γ-rays was 3.3 +- 0.2 while for helium ions it was 1.2 +- 0.1. Mitotic delay was greatest in those cells that had

progressed furthest in their cycle at the time of irradiation. No significant mitotic delay was observed in the post-irradiation generation. Division probability was significantly reduced by irradiation both in the irradiated and in the post-irradiated generation. The reduction in division probability obtained with 3 Gy of neon ions was similar to that obtained after irradiation with 6 Gy of helium ions or ^{60}Co γ-rays.

32542 Bone marrow transfusions in previously irradiated, hematologically normal syngeneic mice. Brecher, G. (Univ. of California, Berkeley); Lawce, H.; Tjio, J.H. Contract W-7405-ENG-48. *Proceedings of the Society for Experimental Biology and Medicine ;* **166**: No. 3, 389-393(Mar 1981).

Transfusion of syngeneic marrow into normal, nonirradiated recipients results only in minimal proliferation of donor cells. However, irradiated recipients, restored to hematologic normalcy by an initial marrow transfusion, subsequently sustain proliferation which replaces approximately 10% of endogenous marrow after a single transfusion of 4 x 10^7 marrow cells of the same strain as the host. Cells from histoincompatible donors proliferate only rarely or minimally in the marrows of these irradiated, but hematologically normal recipients without reirradiation. Syngeneic male donor cells proliferate in irradiated and restored female mice, while female donor cells fail to proliferate in the marrow of syngeneic male recipients. A possible explanation is that transfused female cells respond immunologically to the abundant H-Y antigen in the male environment and are eliminated as a result.

32543 Mutation induction in Haemophilus influenzae by ICR-191. Pt. 1. Development of a detection system for frameshift mutations. Perdue, S.W.; Kimball, R.F.; McGray, P.C. (Oak Ridge National Lab., TN (USA). Biology Div.; Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences). *Mutation Research ;* **80**: No. 2, 239-248(Feb 1981).

The investigation of mutagenic mechanisms in Haemophilus influenzae has been confined until now to mutagens that normally produce mainly base pair substitutions. This paper describes the development of a system suitable for detecting frameshift mutations induced by ICR-191. The system involves reversions from thymidine dependence to thymidine independence. Evidence is presented from a comparison of the responses to ICR-191 and to N-methyl-N'-nitro-N-nitrosoguanidine that the system is specific for frameshift mutations. The genetic recombination involved in transformation leads to a marked increase in spontaneous reversion of the frameshift mutations but not of the base substitution mutations. Presumably, this is a consequence of mispairing, with consequent change in the number of bases, during the recombination.

32544 Photoreactivation of ultraviolet irradiated non-dividing populations of ICR 2A frog cells. Rosenstein, B.S.; Kantor, G.J. (Brookhaven National Lab., Upton, NY (USA)). *Photochemistry and Photobiology ;* **33**: No. 1, 85-89(Jan 1981).

Ultraviolet (uv) irradiation of non-dividing populations of ICR 2A frog cells led to their detachment from the surface of the culture dish and eventual lysis. Exposure of the cells to photoreactivating light after uv irradiation prevented cell killing and was accompanied by a loss of endonuclease sensitive sites from DNA. This photoreversal did not take place when the cells were exposed at 4°C to photoreactivating light indicating that the reversal was the result of photoenzymatic repair. As the action of photoreactivating enzyme is specific for the repair of pyrimidine dimers in DNA, the results suggest that pyrimidine dimers in DNA are the critical lesions leading to the death of non-dividing populations of uv irradiated cells.

32545 Mitogenic stimulation of peripheral lymphocytes from radium workers. Serio, C.S.; Henning, C.B.; Toohey, R.E.; Lloyd, E.L. (Argonne National Lab., IL (USA)). *International Journal of Radiation Biology and Related Studies in Physics, Chemistry and Medicine ;* **38**: No. 5, 585-588(Nov 1980).

Lymphocyte transformations stimulated by phytohemagglutinin, conconavalin A and pokeweed have been used as a measure of the immunocompetence of 45 former radium dial painters (8 male and 37 female). Nine of these cases with ages ranging from 69 to 81 had body burdens greater than 0.1 μCi ^{226}Ra. The ages of those with body burdens less than 0.1 μCi ranged from 45 to 80 with the exception of one patient, age 22. None showed any clinical signs of neoplasia. A decrease in lymphocyte responsiveness from radium cases relative to control subjects was observed with each of the mitogens tested, but it was not possible to correlate the observed decrease with the body burden of radium, difference in age, sex, or smoking habits.

32546 Potentiation of cigarette smoking and radiation: evidence from a sputum cytology survey among uranium miners and controls. Band, P.; Feldstein, M.; Saccomanno, G.; Watson, L.; King, G. (Hospital Notre Dame, Montreal, Quebec). *Cancer ;* **45**: No. 6, 1273-1277(15 Mar 1980).

To assess the effect of cigarette smoking and of exposure to radon daughters, a prospective survey consisting of periodic sputum cytology evaluation was initiated among 249 underground uranium miners and 123 male controls. Sputum cytology specimens showing moderate atypia, marked atypia, or cancer cells were classified as abnormal. As compared to control smokers, miners who smoke had a significantly higher incidence of abnormal cytology ($P = 0.025$). For miner smokers, the observed frequencies of abnormal cytology were linearly related to cumulative exposure to radon daughters and to the number of years of uranium mining. A statistical model relating the probability of abnormal cytology to the risk factors was investigated using a binary logistic regression. The estimated frequency of abnormal cytology was significantly dependent, for controls, on the duration of cigarette smoking, and for miners, on the duration of cigarette smoking and of uranium mining.

32547 Effects of cranial radiation on hearing in children with acute lymphocytic leukemia. Thibadoux, G.M.; Pereira, W.V.; Hodges, J.M.; Aur, R.J. (St. Jude Children's Research Hospital, Memphis, TN). *Journal of Pediatrics ;* **96**: No. 3, 403-406(Mar 1980).

The hearing sensitivity of 61 children with acute lymphocytic leukemia who were admitted to our Total Therapy IX study between December 1975 and July 1977 was studied. Their treatment included combined chemotherapy, 2400 rads of cranial radiation, and intrathecal methotrexate. Subjects initially received an otologic examination and middle ear function testing. Audiometric testing was not done until ears were free of outer or middle ear pathology. If the child had no outer or middle ear disease, audiometric thresholds were obtained for the test frequencies: 500, 1000, 2000, 4000, 6000, and 8000 Hz. Pure-tone thresholds were obtained before irradiation (61 patients) and at 6, 12, and 36 months thereafter (49, 46, and 22 patients, respectively). The median age of time of baseline testing was 10 years, 2 months. A paired sample test based on group data was used to test whether there were any significant changes from the threshold values at 6, 12, and 36 months after irradiation. Thresholds were not significantly affected for any test frequency at any test time. Assessments of individual audiograms indicated that none of the children had any significant reductions in hearing levels at the end of the third year after cranial irradiation.

32548 Mutation of Chinese hamster cells by near-uv activation of promutagens. Barnhart, B.J.; Cox, S.H. (Los Alamos Scientific Lab., NM (USA). Life Sciences Div.). *Mutation Research ;* **72**: 135-142(1980).

A tissue-culture assay for mutagenesis and cytotoxicity incorporating near ultraviolet (NUV) light activation of polyaromatic hydrocarbons (PAH) has been developed. Cultures of Chinese hamster cells (line CHO) growing in suspension culture were inoculated with benzo[a]pyrene (B[a]P), 7,12-dimethylbenzanthracene (DMBA) or shale-oil retort-water and exposed to light from a high-pressure mercury lamp fitted with a Corning NUV bandpass filter. This light source both permitted activation of PAH and the shale-oil water and precluded detectable damage to DNA. Neither the PAH nor the NUV alone had any effect on cell survival or mutation frequencies but the chemicals plus NUV were extremely effective in producing mutations to 6-thioguanine resistance (hgprt gene).

32549 Cells, targets, and molecules in radiation biology. Elkind, M.M. (Argonne National Lab., IL). pp 71-93 of Radiation biology in cancer research. Meyn, R.E.; Withers, H.R. (eds.). New York, NY; Raven Press (1980).

Presented is an overview of radiation damage/repair processes in mammalian cells and speculations concerning the mechanisms of damage/repair. Discussed in detail are inactivation models, dose-response curves and cancer research, repair relative to damage accumulation, repair of potentially lethal versus sublethal damage, repair of single-hit damage, cell killing, and DNA damage and repair. (DLS)

5602 Thermal Effects

REFER ALSO TO CITATION(S) 31946, 32511

32550 (PB—81-110801) Power plant waste heat utilization in aquaculture. Volume III. Final report, 1 November 1976-1 November 1979. Farmanfarmaian, A. (Public Service Electric and Gas Co., Newark, NJ (USA). Research and Development Dept.). Mar 1980. 133p. NTIS, PC A07/MF A01.

This report is part of a three year research study on the constructive use of electric generating station waste heat in cooling water effluents for fish production. It describes procedures and methods for the commercial culture of the giant fresh water shrimp, Macrobrachium rosenbergii, and the rainbow trout, Salmo gairdneri, in the thermal discharge water of the Mercer Power Plant in Trenton, New Jersey. Discharge water from this plant was used in a preliminary assessment of the survival, growth, and food conversion ratio of these species. It was shown that acute or chronic exposure to power plant intake and discharge water; discharge with or without coal particles; and discharge with or without slurry overflow mix does not significantly affect metabolism, short-term survival, growth, or conversion efficiency of shrimp or trout.

32551 (PB—81-132052) Evaluation of C.P. Crane generating station thermal discharge effects on the finfish community. Final report. Gaw, J. (Texas Instruments, Inc., Dallas (USA). Ecological Services). Oct 1980. 227p. NTIS, PC A11/MF A01.

The primary objective of the C.P. Crane finfish thermal effects study, was to determine whether the distribution and health of the finfish community differed between heated and non-heated areas in the plant vicinity. Sampling was conducted with trawls, gill nets, and beach seines during the summer, spring, and winter seasons. Statistically significant differences were observed for spot and white perch. The degree and amount of parasitism was examined and was found to be significant only during the spring months.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 31548, 31754, 31944, 32411, 32472, 32500, 32504, 32513, 32798

32552 (BNL—51379) Microbial activity in acid and acidified forest soils. Francis, A.J.; Olson, D.; Bernatsky, R. (Brookhaven National Lab., Upton, NY (USA)). Mar 1981. Contract AC02-76CH00016. 31p. NTIS, PC A03/MF A01. Order Number DE81030149.

Effect of soil acidity on microbial decomposition of organic matter, transformation of nitrogen, and soil chemical and biological properties of an acid forest soil were investigated. The rates of organic matter decomposition by natural acid soil and by pH-adjusted acid and neutral soils which were preincubated for 14 and 150 days were determined by monitoring CO_2 evolution. In the control (unamended) pH-adjusted acid soil, reductions in CO_2 production of 14% by 14-day preincubated samples and of 52% by 150-day samples were observed. In the oak-leaf-amended acidified soils, the CO_2 production by 14- and 150-day preincubated samples decreased by about 6 and 37%, respectively. Ammonification and nitrification in the natural acid and pH-adjusted acid soils were determined. In addition, the contribution of nitrate by heterotrophic microbial communities in natural acid and pH-adjusted acid soils was examined. Ammonia formation in the pH-adjusted acid soil was 50% less than in the natural acid soil. An increase in nitrate concentration in the pH-adjusted acid soil over that in the natural acid soil was observed. Increased rates of ammonification and nitrification were observed in the pH-adjusted neutral soil. Little autotrophic nitrifying activity was detected in natural acid and acidified forest soils and no detectable heterotrophic nitrification was observed. The data indicate that ammonification and nitrification are affected by an increase in soil acidity. These results suggest that further acidification of acid forest soils by addition of sulfuric acid or by acid precipitation may lead to significant reductions in the leaf litter decomposition, ammonification, and nitrification, and thus affect the nutrient recycling in the forest ecosystem.

32553 (DOE/EV/04477—2) Paramecium tetraurelia. Pre-screen for hazardous chemicals: a rapid-detector system for health hazards. Progress report. Smith-Sonneborn, J. (Wyoming Univ., Laramie (USA). Dept. of Zoology and Physiology). 1981. Contract AS02-77EV04477. 18p. NTIS, PC A02/MF A01. Order Number DE81025884.

Genotoxic and cytotoxic effects of dilutions of oil shale process waters from three different retorting processes were evaluated using the Paramecium tetraurelia and the Salmonella assays. Process waters from above-ground, true in situ, and modified retorting process were analyzed. Significant mutagenicity was detected in waste water from both the above-ground and true in situ retorting processes in both the Salmonella and Paramecium bioassays. The Salmonella assay required the addition of the rat liver S9 fraction; the Paramecium bioassay was more sensitive to genotoxic effects from an above-ground retort water without the addition of the rat liver fraction. Mutagenicity of the dilutions tested from the modified retort process was detected only in the Paramecium system. The waste water from the above-ground retort process was the most toxic to both the protozoan and bacteria. Since the chemical composition of oil shale process waters can vary with: 1) the retorting process used, 2) the temperature of the retorting, 3) the composition of the shale rock, and 4) the sampling and storage procedures, the differences in biological activity observed between water can reflect differences in water contamination.

32554 (DOE/EV/10100—T1) Technical progress report, April 1, 1979-July 31, 1981. (AMC Cancer Research Center and Hospital, Lakewood, CO (USA)). 1981. Contract AC02-79EV10100. 14p. NTIS, PC A02/MF A01. Order Number DE81026131.

Mutagen testing of carcinogens, both negative and positive in the Ames test was continued for their potency to elevate progesterone levels. The following compounds did not elevate progesterone levels in chicks. Non-mutagenic carcinogens were: phenobarbital, safrole, ethylcarbamate (urethane), dimethylhydrazine, carbon tetrachloride. Mutagenic carcinogens were: benzopyrene, 3-methylcholanthrene, aflatoxin B_1 and N-fluorenylacetamide (2-acetylaminfluorene). The preliminary results in rats indicated that the effects of ethionine on the progesterone level are not solely confined to chicks; so research can continue using rats as the experimental animal. (PSB)

32555 (DOE/EV/10259—2) Geographic analysis of thermal equilibria: a bioenergetic model for predicting thermal response of aquatic-insect communities. Technical progress report, July 1, 1980-December 31, 1981 and proposed research program, January 1, 1982-June 30, 1983. Vannote, R.L.; Sweeney, B.W. (Academy of Natural Sciences, Avondale, PA (USA). Stroud Water Research Center). 28 Aug 1981. Contract AC02-79EV10259. 85p. NTIS, PC A05/MF A01. Order Number DE81029680.

The principal objective is to test and refine a conceptual model describing the effects of natural and altered temperature regimes on laval growth and adult size and fecundity of hemimetaboloyus aquatic insects. The central hypothesis is that the stability of a given population (i.e. the ability to recover from serious reduction in numbers by environmental perturbations or fluctuations) within the geographic range of a species reflects mainly a dynamic equilibrium between temperature and individual growth, metabolism, reproductive potential, and generation time. In this context, a thermal regime is viewed as optimum for a species when individual body weight and fecundity is maximized. The model predicts that geo-

graphic range extension away from a location with an optimum thermal regime would be associated with temperature induced changes in the rate and efficiency of energy use, developmental processes, and generation time. To test and refine the model, we proposed to study the growth, development, metabolism, and reproduction of a large number of aquatic species in both the natural riverine environment and under controlled laboratory conditions. Field studies were designed to focus on several populations of each species at various locations along a natural thermal gradient throughout its geographic range. Laboratory studies emphasize the relative importance of temperature and nutrition of larval growth and adult reproduction of a number of aquatic species commonly represented at field sites.

32556 **(DOE/EY/22874—43) Statistics and environmental factors in health. Three year study.** (Columbia Univ., New York (USA). School of Public Health). 1981. Contract AS02-76EV02874. 632p. NTIS, PC A99/MF A01. Order Number DE81028487.

Selected technical reports which were produced during the years 1976-79 as a result of the Siam Institute for Mathematics and Society (SIMS) Three Year Study on Statistics and Environmental Factors in Health are presented. Members of the Study have been Columbia University, Stanford University, and SIMS. The Columbia University component of the SIMS study concentrated on biostatistical and epidemiological studies of the health effects of air pollution. Eleven papers are presented. Thirteen Stanford University produced papers are included under the following section headings: air pollution and health; temporal and spatial stochastic models; and extreme values. (JGB)

32557 **(EPA/600/9—81-001) Proceedings of the research planning workshop on health effects of oxidants.** (Northrop Services, Inc., Research Triangle Park, NC (USA)). Jan 1981. 450p. (CONF-800125—). Environmental Protection Agency, Research Triangle Park, NC. Order Number DE81902847.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Thirty-eight presentations at the research planning workshop on health effects of oxidants are documented with an introduction and record of a panel discussion which concluded the workshop. Topics documented fall into five categories: regulatory activities and concerns, overviews of research programs, animal studies, human studies, and biomathematical modeling. Sections 13 (pp 135-144) and 14 (pp 145-152) have previously been put into the DOE EDB. (DLS)

32558 (EPA/600/9—81-001, pp 78-90) **Interactions between hypertension and oxidant air pollutants.** Drew, R.T.; Costa, D.L.; Haber, S.; Iwai, J. (Brookhaven National Lab., Upton, NY). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research shows the interaction of two air pollutants, sulfur dioxide and ozone, with a hypertensive model in rats. Interactions are discussed in terms of blood pressure and the relationships of dietary salt intake. (DLS)

32559 (EPA/600/9—81-001, pp 91-125) **Effects of ozone on rat erythrocytes after exposure in vivo.** Schaich, K.M.; Borg, D.C. (Brookhaven National Lab., Upton, NY). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research shows the biological effects of ozone inhalation on rat erythrocytes. These effects were studied by the monitoring of lipid oxidation and directly related oxidative damage in red blood cells, destruction of red cell membrane integrity, appearance of thiobarbituric acid reactive products or fluorescence characteristic of iminopropen compounds, changes in thin-layer chromatography patterns of extracted lipids, analysis for reduced glutathione enzymes, and hemolysis. (DLS)

32560 (EPA/600/9—81-001, pp 126-134) **Pathogenesis of chronic lung disease: the role of toxicological interaction.** Witschi, H. (Oak Ridge National Lab., TN). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research shows the synergistic interactions of an antioxidant, BHT, and oxygen using mice. Morphological examinations of lung tissues revealed a form of chronic lung damage, interstitial fibrosis, possibly induced during epithelial cell proliferation. (DLS)

32561 (EPA/600/9—81-001, pp 171-179) **Cardiovascular effects of ozone and cadmium inhalation in the rat.** Revis, N.W.; Major, T.; Dalbey, W.E. (Oak Ridge National Lab., TN). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Biological effects upon the cardiovascular system of rats caused by the inhalation of cadmium or ozone were studied by observing femoral artery pressure and blood norepinephrine levels. (DLS)

32562 (EPA/600/9—81-001, pp 180-188) **Effects of nitrogen dioxide and 3-methylfuran inhalation on the small airways in the mouse.** Haschek, W.M. (Oak Ridge National Lab., TN). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research shows the cell killing action and synergistic interactions of 3-methylfuran and nitrogen dioxide in the respiratory system of mice. (DLS)

32563 (EPA/600/9—81-001, pp 189-197) **Overview of research at Lawrence Berkeley Laboratory.** Alpen, E.L. (Univ. of California, Berkeley). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Results from two oxidants research projects that were conducted at Lawrence Berkeley Laboratory under EPA sponsorship are summarized. The first project examined carcinogenic effects of nitrogen dioxide and sulfur dioxide in mice while the second project examined the effects of low-level ozone exposure on serum lipoproteins in guinea pigs. (DLS)

32564 (EPA/600/9—81-001, pp 198-200) **Overview of research at the University of California - Davis.** Goldman, M. (Univ. of California, Davis). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Oxidants research programs within the laboratory for energy related health research at the University of California - Davis are reviewed. Approaches to research and current efforts are discussed with emphasis upon airborne particulates from coal combustion. (DLS)

32565 (EPA/600/9—81-001, pp 201-208) **Pulmonary effects of ozone in the rat and monkey.** Dungworth, D.L. (Univ. of California, Davis). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research shows the effects of ozone on lung growth and the evolution of chronic damage from low-level exposure with emphasis on biological adaptation in rats and monkeys. (DLS)

32566 (EPA/600/9—81-001, pp 209-215) **Biological effects of fly ash from coal combustion.** Raabe, O. (Univ. of California, Davis). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research at the laboratory for energy related health research shows the biological effects of fly ash in combination with sulfur

dioxide from coal-burning power plants. The research program assesses the biological activity of these materials using short-term bioassay systems (Ames assay) and inhalation exposures in whole animals. (DLS)

32567 (EPA/600/9—81-001, pp 216-221) **Overview of research at the Inhalation Toxicology Research Institute.** Mauderly, J.L. (Inhalation Toxicology Research Inst., Albuquerque, NM). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

The Inhalation Toxicology Research Institute is overviewed, including descriptions of the Institute's resources and of current research on oxidant air pollutants. (DLS)

32568 (EPA/600/9—81-001, pp 222-228) **Cellular (in vivo) and biochemical changes following inhalation of acid sulfates: rapid screening tests to determine the pulmonary response to combined pollutant exposures.** Henderson, R.F. (Inhalation Toxicology Research Inst., Albuquerque, NM). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

The cellular and biochemical changes after the inhalation of acid sulfates were studied by using bioassays that involved short-term in vivo inhalation exposures followed by rapid evaluation of pulmonary response. Lavage fluid analysis, ^{14}C-thymidine incorporation in lung cells, and ^{14}C-palmitate uptake into membrane lipids were all observed in hamsters to detect pulmonary response. (DLS)

32569 (EPA/600/9—81-001, pp 229-242) **Respiratory toxicology of nitrogen oxides.** Pickrell, J.A. (Inhalation Toxicology Research Inst., Albuquerque, NM). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

The effects of nitrogen oxides upon the lungs and lung cells are reported for hamsters and rats with special emphasis upon synergistic interactions with ozone and fly ash. Pathological assessment included cytological, biochemical, and immunological data. (DLS)

32570 (EPA/600/9—81-001, pp 243-255) **Acute-chronic loss of lung function following inhalation of acid sulfates.** Silbaugh, S.A. (Inhalation Toxicology Research Inst., Albuquerque, NM). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Respiratory system responses to inhalation exposures of sulfuric acids are reported by examining pulmonary function and biological adaptation in guinea pigs. The synergistic interactions of sulfuric acid and nitrogen dioxide or fly ash are also studied. (DLS)

32571 (EPA/600/9—81-001, pp 256-265) **Lung clearance mechanisms following inhalation of acid sulfates.** Wolff, R.K. (Inhalation Toxicology Research Inst., Albuquerque, NM). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Dose-response relationships between impairment of tracheal mucous clearance and acid sulfate concentration in acute and chronic exposures of beagles, rats, and guinea pigs are reported. (DLS)

32572 (EPA/600/9—81-001, pp 266-276) **Overview of current and planned research by the Inhalation Toxicology Branch.** Gardner, D.E. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

An overview of current and projected research on oxidants by the Inhalation Toxicology Branch (Environmental Toxicology Division, Health Effects Research Laboratory, Office of Research and Development, US EPA). Included are discussions of staff, facilities, and budget along with reports of effects of exposure to O_3, NO_2, and peroxyacetal nitrate. (DLS)

32573 (EPA/600/9—81-001, pp 277-288) **Some specific studies planned by the inhalation toxicology branch.** Graham, J.A. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Oxidant toxicology research programs are overviewed with intent to indicate the focus and scope of these studies sponsored by the Inhalation Toxicology Branch (Environmental Toxicology Division, Health Effects Research Laboratory, Office of Research and Development, US EPA). Specific discussion of chronic NO_2 exposure using mouse infectivity model, pentobarbital induced sleeping time in the mouse, sensitivity to bronchoconstricting agents, and studies to identify susceptible populations are included. (DLS)

32574 (EPA/600/9—81-001, pp 289-300) **Biomathematical modeling of oxidant toxicity.** Miller, F.J. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Described are preliminary attempts to biomathematically model the deposition of ozone using data from both man and laboratory animal studies. Emphasis is placed upon research needs for a better understanding of gas transport in the mucous membranes. (DLS)

32575 (EPA/600/9—81-001, pp 301-303) **Overview of current and planned research by the Human Studies Division.** Lee, R.E. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Epidemiological and clinical research programs of the Human Studies Division (Health Effects Research Laboratory, Office of Research and Development, US EPA) are overviewed with emphasis upon cytogenetic studies of photochemical oxidant exposure. (DLS)

32576 (EPA/600/9—81-001, pp 304-313) **Human pulmonary adaptation to ozone.** Haak, E.D. Jr. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Results show the dependence of pulmonary response in young men to short-term exposures of ozone upon factors of dose, ventilation level, duration of exposure, proximity of pulmonary function testing to exposure peaks, attitude, previous exposure experience, humidity, and temperature. (DLS)

32577 (EPA/600/9—81-001, pp 314-327) **Ozone-induced hyperreactivity as measured by histamine challenge in normal healthy subjects.** Hazucha, M.J. (Univ. of North Carolina, Chapel Hill). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Studies demonstrate ozone induced impairment of dynamic lung function and increased sensitivity of the tracheobronchial tree. Histamine bronchial challenge is used as a screening test for ozone reactivity. (DLS)

32578 (EPA/600/9—81-001, pp 328-340) **Response of normals and asthmatics to low-level nitrogen dioxide.** Ginsberg, J.F. (Environmental Protection Agency, Research Triangle Park, NC). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Comparative evaluations are made between normal and asthmatic subjects responses to low-level NO_2 bronchial challenge using specific airway resistance data. (DLS)

32579 (EPA/600/9—81-001, pp 368-377) **Lung injury and depletion in the mouse following exposure to nitrogen dioxide.** Sherwin, R.P. (Univ. of Southern California, Los Angeles). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Preliminary experimental animal data are summarized showing Type II cell hyperplasia and protein leakage at higher levels of NO_2 exposure. (DLS)

32580 (EPA/600/9—81-001, pp 378-382) **Pulmonary and psychophysiological effects of ozone.** Horvath, S.M. (Univ. of California, Santa Barbara). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Preliminary results from human clinical exposures to ozone are summarized with special focus on pulmonary response to O_3 in combination with exercise and effects of O_3 upon the central nervous system. (DLS)

32581 (EPA/600/9—81-001, pp 383-394) **Epidemiologic studies of oxidant health effects in the Los Angeles area.** Detels, R. (Univ. of California, Los Angeles). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Preliminary results of a cross-sectional study of epidemiologic investigations into lung performance tests and oxidant exposure dose are presented for the Los Angeles area. (DLS)

32582 (EPA/600/9—81-001, pp 395-410) **Proposed scientific program of the cooperative study of oxidant health effects in the Los Angeles area.** Dawson, S.V. (California Air Resources Board, Sacramento). Jan 1981. Environmental Protection Agency, Research Triangle Park, NC.

From Environmental Protection Agency oxidants research planning workshop; Raleigh, NC, USA (27 Jan 1980).

Research programs are described for the epidemiologic study of health effects of oxidants in the Los Angeles area. An integrated plan of human laboratory exposure, animal laboratory exposure, and epidemiologic data is described. (DLS)

32583 (LA-UR—81-2309) **Viewpoint on occupational health in the oil-shale industry.** Voelz, G.L.; Grier, R.S.; Hargis, K.M. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-810838—1). NTIS, PC A02/MF A01. Order Number DE81028698.

From Conference on oil shale, the environmental challenges II; Vail, CO, USA (10 Aug 1981).

In assessing the potential health and safety hazards which may be expected in a large-scale oil shale industry, the types of operations that will be utilized to extract oil from oil shale are examined. These are broadly characterized as mining, raw shale processing and handling, retorting and refining, and spent shale disposal. With few exceptions, these operations in shale oil production are similar to operations in existing industries. Health and safety risks and occupational health controls are also expected to be similar. To date medical studies on workers in the oil shale industry who have been exposed to shale dusts and oil products have indicated that the chief problem areas are pneumoconiosis and skin cancers. A broad viewpoint of the prospective occupational health problems in the oil shale industry can be obtained by reviewing similar activities and exposures in other industrial operations. This viewpoint would suggest that the prospective problems can be controlled adequately by conventional methods of worker protection. Several unique situations do exist in this industry. The mining and material handling of tonnages of oil shale exceeds any experience in other mining activities. This is a problem of scale. It seems unlikely that it will produce new safety problems. The in situ mining offers the unique situation of burning and abandoned underground retorts in near proximity to work forces preparing future in situ retorts. The potential of exposures to dusts, gases and vapors will simply have to be measured as such operations come on stream. Measurements made to date have not shown unique hazards to exist, although existing data are limited to demonstration-scale retorts burning one-at-a-time under normal conditions.

32584 (ORNL—5806) **Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.** Pfuderer, H.A.; Moody, J.B. (comps.). (Oak Ridge National Lab., TN (USA)). Jul 1981. Contract W-7405-ENG-26. 62p. NTIS, PC A04/MF A01. Order Number DE81027864.

Separate abstracts were prepared for each of the 6 chapters presented by the six divisions involved in the Biomedical and Environmental Sciences Program at Oak Ridge National Laboratory. The introduction is not covered by an abstract and deals with the environmental, health and safety considerations of energy technology decisions, the major initiatives now being taken by these 6 divisions, and recent major accomplishments in the biomedical and environmental science program. (KRM)

32585 (ORNL—5806, pp 19-25) **Biology Division.** Jul 1981. NTIS, PC A04/MF A01.

In Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.

The major objective of the Biology Division has been to develop a scientific foundation for evaluating the health effects of new and changing energy technologies. At the present time, the area of interest is the investigation of various chemicals and complex substances produced by a variety of energy technologies, especially that of fossil fuels. The research interests of each of the four sections of the Biology Division are outlined briefly, and recent accomplishments of the Biology Division staff are reviewed. (KRM)

32586 (ORNL—5806, pp 37-44) **Health and Safety Research Division.** Jul 1981. NTIS, PC A04/MF A01.

In Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.

The programs of the Health and Safety Research Division encompass a broad range of basic and applied research defining how energy-related technologies affect man. Approximately one-third of the effort is in basic studies at atomic and molecular levels and is supported almost entirely by DOE's Office of Health and Environmental Research. The remainder of the Division's programs is of a more applied nature and receives more diverse funding from within DOE and other agencies. Some of the Division's special skills including negative ion physics, electron- and ion-molecule interactions, electron attachment and detachment processes, laser spectroscopy, wake theory, gaseous dielectrics, nuclear medicine, modeling radionuclide transport to man, radiation dosimetry, decontamination and decommissioning surveys, developing and testing instrumentation to measure exposures of humans to chemicals, and uncertainty analysis of assessment models are discussed. A selection of some recent accomplishments is listed.

32587 (PB—81-110884) **Development of recommended test method for toxicological assessment of inhaled combustion products. Final report.** Birky, M.M.; Paabo, M.; Levin, B.C.; Womble, S.E.; Malek, D. (National Engineering Lab. (NBS), Washington, DC (USA)). Sep 1980. 56p. NTIS, PC A04/MF A01.

The objective of the project supported by PRC was to develop a test method for measuring the toxicity of combustion products from polymeric materials including cellular plastics. The development of such a test procedure was considered an essential first step to determine the hazard to life when cellular plastics are involved in fire. As result of this work, a test procedure was developed. It consists of 3 major elements; (1) combustion system, (2) chemical analysis system and (3) animal exposure system. Two biological endpoints obtained from the exposure are: (1) incapacitation in 30 minute exposure period, and (2) lethality in 30 minutes plus 14 days post exposure. The test apparatus has been evaluated to determine mixing rates and loss of reactive chemicals in the exposure

chamber. In addition, a statistical evaluation of the experimental results demonstrated that order of incapacitation was independent of animal location. Evaluation of a limited number of different materials that produce different toxicological syndromes has demonstrated the utility of all 3 endpoints. Two natural polymers (wood and wool) and 2 synthetic materials (modacrylic and PTFE) have been studied in detail. In addition, preliminary data have been obtained on a flexible polyurethane foam (CM-21).

32588 **(PB—81-127532) Concordance of heavy metal and antibiotic resistance on plasmids of Chesapeake Bay bacteria. Technical report.** McNicol, L.A. (Maryland Univ., College Park (USA). Water Resources Research Center). Oct 1980. Contract DI-14-34-0001-9022. 87p. NTIS, PC A05/MF A01.

Antibiotic-resistant and heavy metal-resistant phenotypic frequency was measured in Chesapeake Bay bacterial strains obtained from Bay sites differing significantly in water quality. The phenotypes were estimated from dose-response curves using direct plating, replica plating, and minimal inhibitory concentration (MIC). Resistant and sensitive organisms could be distinguished by concentrations of twenty micrograms per milliliter for various antibiotics (ampicillin, chloramphenicol, nalidixic acid, penicillin, streptomycin, and tetracycline), and of 0.05 millimolar for the heavy metals tested (cadmium, mercury, nickel, and lead). Individual resistance phenotypes of 1816 isolates were determined with the replica technique, with 85% resistant to at least one antibiotic and a surprising 2% resistant to all six drugs tested. Occurrence of resistant organisms did not correlate with water quality, sampling location, season, sample type, or physical parameters of the site. Ninety-two percent of organisms examined were resistant to at least one metal studied, with 43% resistant to all metals, but resistance did not correlate with any station or sample parameters. Metal and drug resistant phenotypes did correlate positively with one another, but these two traits were not appreciably linked on plasmid DNA.

32589 **(PB—81-133159) Highway operation and plant damage. Final report.** Leiser, A.T.; Palaniyandi, R.; Paul, J.L.; Raabe, R. (California Univ., Davis (USA). Dept. of Environmental Horticulture). Apr 1980. 264p. NTIS, PC A12/MF A01.

A five year study investigated the relationship between highway operation and plant damage in the Tahoe Basin and adjacent highways. These studies include field surveys, greenhouse studies, soil salt application trials, foliar salt application trials, an Armillaria root rot inoculation study, a seasonal fluctuation of salt study, the effect of temperature on salt uptake and a bark absorption of salt study. Highway deicing salt is a cause of damage on conifers, usually limited to 30 feet from the pavement edge. Drainage patterns and salt carried by aerosols may extend damage farther from the pavement. Of the four principal conifers in the study area, Jeffrey pine and lodgepole pine appeared the most tolerant of salt and incense cedar was the most susceptible.

32590 **Expression of keratin and vimentin intermediate filaments in rabbit bladder epithelial cells at different stages of benzo[a]pyrene-induced neoplastic progression.** Summerhayes, I.C. (Harvard Medical School, Boston, MA); Cheng, Y.S.E.; Sun, T.T.; Chen, L.B. *Journal of Cell Biology ;* **90**: No. 1, 63-69(Jul 1981).

Rabbit bladder epithelium, grown on collagen gels and exposed to the chemical carcinogen benzo[a]pyrene, produced nontumorigenic altered foci as well as tumorigenic epithelial cell lines during 120 to 180 d in culture. Immunofluorescence studies revealed extensive keratin filaments in both primary epithelial cells and benzo[a]pyrene-induced altered epithelial foci but showed no detectable vimentin filaments. The absence of vimentin expression in these cells was confirmed by two-dimensional gel electrophoresis. In contrast, immunofluorescence staining of the cloned benzo[a]pyrene-transformed rabbit bladder epithelial cell line, RBC-1, revealed a reduction in filamentous keratin concomitant with the expression of vimentin filaments. The epithelial nature of this cell line was established by the observation that cells injected into nude mice formed well-differentiated adenocarcinomas. Frozen sections of such tumors showed strong staining with antikeratins antibodies, but no detectable staining with antivimentin antibodies. These results demonstrated a differential expression of intermediate filament type in cells at different stages of neoplastic progression and in cells maintained in different growth environments. It is apparent that the expression of intermediate filaments throughout neoplastic progression is best studied by use of an in vivo model system in parallel with culture studies.

32591 **Relationship of blood cadmium level to hypertension and plasma norepinephrine level: a Romanian study (41159).** Revis, N.W.; Zinsmeister, A.R. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Proceedings of the Society for Experimental Biology and Medicine ;* **167**: No. 2, 254-260(Jun 1981).

The associations of blood cadmium levels with hypertension and plasma norepinephrine concentrations were determined in normotensive and hypertensive nonsmokers and smokers. Statistical analysis showed that after adjustment for age alone, the estimated mean values of blood cadmium and plasma norepinephrine in nonsmokers were significantly lower than in smokers. However, after adjustment for age and blood cadmium, the estimated mean values for plasma norepinephrine were not significantly different between nonsmokers and smokers or normotensives and hypertensives. In contrast the estimated mean value for blood cadmium as a function of blood pressure and smoking habit was still significant after adjustment for age and plasma norepinephrine. We suggest that smoking and blood pressure affect the level of blood cadmium, and through this change in blood cadmium the level of plasma norepinephrine is affected.

5604 Other Environmental Pollutant Effects

32592 **(PNL-SA—9098) Evaluation of the usefulness of ecological simulation models in power plant impact assessment.** Swartzman, G.L.; Haar, R.T.; McKenzie, D.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1981. Contract AC06-76RL01830. 12p. (CONF-810488—2). NTIS, PC A02/MF A01.

From International symposium on energy and ecological modelling; Louisville, KY, USA (20 Apr 1981).

Comparisons were made of the equations, rationale, data sources and parameter values of 26 simulation models of fish and zooplankton population dynamics and energetics and results were compared in standard notation and units, process by process. The major process categories considered were consumption, predation, metabolic processes, assimilation, growth, fecundity, recruitment and mortality. A model simulation language, AEGIS (Aquatic Ecosystem General Impact Simulator) was built to compare model equations process by process allowing convenient interchange of model equations for any process module. This simulator was parameterized to a test site, Lake Keowee, South Carolina, on which resides the Oconee Nuclear Power Station. Model parameter estimation and comparison of these models with biological monitoring data allows eveluation of ecosystem models from the standpoint of prediction of behavior under normal and perturbed conditions, organization of data into an ecosystem framework, and evaluation of data to address impact questions.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 31828, 32546

32593 **(DOE/NV/00410—21-Rev.7) Cross-index to DOE-prescribed occupational safety codes and standards.** (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). Jan 1981. Contract AC08-76NV00410. 665p. NTIS, PC A99/MF A01. Order Number DE81030475.

This Cross-Index volume is the 1981 compilation of detailed information from more than three hundred and fifty DOE prescribed or OSHA referenced industrial safety codes and standards and is revised yearly to provide information from current codes. Condensed data from individual code portions are listed according to reference code, section, paragraph and page. Each code is given a two-digit reference code number or letter in the Contents section (pages C to L) of this volume. This reference code provides ready identification of any code listed in the Cross-Index. The computerized information listings are on the left-hand portion of Cross-Index

page; in order to the right of the listing are the reference code letters or numbers, the section, paragraph and page of the referenced code containing expanded information on the individual listing.

32594 **(HRD—80-81) Legislation allows Black Lung benefits to be awarded without adequate evidence of disability.** (General Accounting Office, Washington, DC (USA)). 28 Jul 1980. 24p. GPO.

Report to Congress by the Comptroller General of the United States.

Social Security Administration approval of black lung claims is based on provisions of law which GAO believes do not adequately ensure that benefits are provided only to those entitled to them. Under the 1977 amendments to the Federal Coal Mine Health and Safety Act such claims were based on affidavits from spouses and other dependent persons, inconclusive medical evidence, and presumptions based on years of coal mine employment. GAO believes that medical evidence should be the basis for determining disability and death from black lung.

32595 **Ethical imperatives of theories.** Crawford, D.J. (Oak Ridge National Lab., TN (USA)). *Health Physics ;* **40**: No. 2, 264(Feb 1981).

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 31666, 31667, 31701, 31705, 31710, 32454

32596 **(DOE/ET/44802—T2) Preliminary analysis of gravity and aeromagnetic surveys of the Timber Mountain Area, southern Nevada.** Kane, M.F.; Webring, M.W.; Bhattacharyya, B.K. (Geological Survey, Denver, CO (USA)). 1981. Contract AI08-78ET44802. 143p. NTIS, PC A07/MF A01. Order Number DE81029462.

Recent (1977 to 1978) gravity and aeromagnetic surveys of the Timber Mountain region, southern Nevada, have revealed new details of subsurface structure and lithology. The data strongly suggest that deformation caused by volcanic events has been accommodated along straight-line faults combining in such a fashion as to given a curvilinear appearance to regional structure. The magnetic data suggest that rock units in the central graben and along the southeast margin of Timber Mountain may have been altered, perhaps thermally, from their original state. The gravity data indicate that the south part of the Timber Mountain is underlain by relatively dense rock possibly intrusive rock, like that which crops out along its southeast side. The gravity data also suggest that the Silent Canyon caldera may extend considerably south of its presently indicated southern limit and may underlie much of the area of Timber Mountain. The moat areas appear to be more rectangular or triangular than annular in shape. The southern part of Timber Mountain caldera is separated from the Yucca Mountain area to the south by a triangular horst. The structural relations of the rock units making up the horst are complex. Several linear terrain features in the southern part of the caldera area are closely aligned with geophysical features, implying that the terrain features are fault-controlled.

32597 **New stratigraphic correlation techniques.** Smith, T.F.; Waterman, M.S. (Los Alamos Scientific Lab., NM). *Journal of Geology ;* **88**: 451-457(1980).

Cross-association is a standard correlation technique. It is valid for theoretically complete stratigraphic sequences, but not for stratigraphic sequences as they commonly occur. A major problem is its inability to include correlations across gaps caused by local nondeposition or eroded strata. The methods proposed in this paper do include correlations across gaps and allow for completely general measurements of strata similarity. In addition, they are extended to include correlation of a fragmentary sequence with a longer complete sequence and to include correlations of more than two sequences. Using these techniques, most problems can be handled by hand calculation.

32598 **United States Geological Survey yearbook, fiscal year 1980.** Washington, DC; Geological Survey (1980). 144p. GPO.

The fiscal year 1980 Yearbook summarizes the activities of the US Geological Survey in response to its scientific and regulatory missions and its responsibility for exploration of the National Petroleum Reserve in Alaska. The main sections of this Yearbook are: (1) the year in review - a brief overview of the significant events of the Geological Survey during fiscal year 1980; (2) perspectives - essays focusing on specific events (rather than scientific topics) and programs involving multi-division participation; (3) missions, organization, and budget - a description of the Geological Survey's major duties and assignments and of the organizational structure that supports its missions; (4) division chapters - a description on the significant accomplishments (rather than a comprehensive program by program discussion) of each of the eight operating divisions and offices; and (5) appendices - provide supplementary information regarding key personnel, cooperators, and selected summary budgetary tables and an index.

32599 **(PB—81-130619) Neogene foraminifera of Sakhalin (foraminifery neogenovich otlozhenit sakhalina leningrad vses).** Voloshinova, N.A.; Kuznetsova, V.N.; Leonenko, L.S. Translated from *Trudy Vsesoyuznogo Neftyanogo Nauchno-Issledovatel'skogo Geologorazvedochnogo Instituta ;* No. 284, vp(1970). 614p. NTIS, PC A99/MF A01.

The book is a monographic description of the foraminifera, having some stratigraphic distribution in the Neogene deposits of the Sakhalin. The book may be used by palaeonologists, studying foraminifera of the Meso-Cenozoic of the USSR and of the whhole Pacific region, and by geologists, working out detailed stratigraphic maps of the Cenozoic of various areas of the Far-Eastern region and Siberia.

5802 Geophysics

REFER ALSO TO CITATION(S) 31628, 31665, 32332, 32596

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 31645, 31721, 31728, 31729, 31734, 31735, 31736, 31738, 31740

32600 **(LBL—13049) Roles of pore pressure and fluid flow in the hydraulic fracture process.** Palen, W.A.; Narasimhan, T.N. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 211p. NTIS, PC A10/MF A01. Order Number DE81029886.

Thesis.

Previous work done in the field of hydraulic fracturing has resulted in a variety of approximate expressions for estimating the fracture length and aperture as a function of time and other process variables. These approximations either ignore fluid flow in the reservoir or assume a constant one-dimensional leakage of fluid from the fracture faces. A model is proposed in this work for analyzing the fracture growth with time, by considering fluid flow in the system and deformation due to pore pressure in the fracture. The model includes the response of the mechanical connections in the system, i.e., the surface pumps, wellbore tubing, and packer cavity. A thermodynamic energy balance based on a Griffith crack criterion is introduced and used in the model to control the rate of fracture growth. This highly non-linear problem necessitates the use of a numerical approach.

32601 **(SAND—81-0938) Formation interface fracturing experiment: an in situ investigation of hydraulic fracture behavior near a material property interface. Final report.** Warpinski, N.R.; Northrop, D.A.; Schmidt, R.A.; Vollendorf, W.C.; Finley, S.J. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1981. Contract AC04-76DP00789. 82p. NTIS, PC A05/MF A01. Order Number DE81026459.

Two hydraulic fractures were created, one above and one below an ash-fall tuff-welded tuff formation interface. These formations have significant differences in their Young's moduli, Poisson's ratios and porosities. Sufficient cement was injected into each zone

to create vertical fractures of 600 ft total length if the height was restricted to 50 ft; 256 and 117 bbls were injected at 6 bbl/min into the ash-fall tuff and welded tuff zones. Mineback along the interface has revealed a total fracture length of 150 ft; coring has shown that the heights of the fractures are about 100 ft for the fracture in the ash-fall tuff and 200 ft for the welded tuff fracture. The fracture which was initiated in the low modulus ash-fall tubb propagated upwards into the higher modulus welded tuff. No containment was observed. The results from the fracture subsequently initiated in the welded tuff are obscured because it propagated alongside the lower fracture and thus provided no definitive information on behavior at the interface. Widths in both the ash-fall and welded tuffs are consistent with design calculations. The in-situ stresses were found to have the greatest effect on fracture behavior and geometry. Variations in the minimum principal in situ stresses controlled the direction of fracture propagation and the final height of the fracture. The low stress measured in the welded tuff probably aided the propagation of the fracture into that region.Natural fractures in the welded tuff caused significant offsets in the induced fractures and resulted in filling of some of the natural fractures with grout and severe fluid Leakoff. These experiments show that material property interfaces should not, in general, be considered containment features. A more likely factor in controlling fracture height is in situ stress differences.

5804 Geochemistry

REFER ALSO TO CITATION(S) 31666, 31668, 31672, 31673, 32443

32602 Thermodynamics of cation hydrolysis. Baes, C.F. Jr.; Mesmer, R.E. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *American Journal of Science ;* **281**: No. 7, 935-962(Sum 1981).

Data for the hydrolysis of aqueous cations are reviewed, enthalpy and entropy values for the various kinds of reactions are compiled, and correlations are drawn with the object of predicting behavior at elevated temperatures. Such information is essential for understanding the chemistry and the transport of metallic elements in hydrothermal environments. Polynuclear species are less important in solution as the temperature increases because of decreasing stability and because the maximum concentration of the hydrolyzing ion in solution is lowered by the decreasing solubility of the oxide or hydroxide. The limited data available for the formation of successive mononuclear hydroxide complexes suggest the accompanying entropy change will decrease with the charge on the reacting species and that the enthalpy of such successive hydrolysis steps will decrease for most cations. Consequently the pH range of dominance of each species, especially, the neutral one, should increase with temperature. The equilibrium between the oxide or hydroxide solid phase and the natural species M(OH)/sub z/(aq), which usually determines the minimum solubility of the solid, is expected to have a small temperature dependence. In more alkaline solutions, where anionic complexes are formed, the solubility should show a positive temperature coefficient at a given pH. Projections based on these correlations of hydrolysis behavior at elevated temperature depend on a knowledge of the stepwise hydrolysis constants for mononuclear species, and more such information is badly needed.

5805 Oceanography

REFER ALSO TO CITATION(S) 31719, 31720

64 PHYSICS RESEARCH

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 32659

32603 (AD-A—092708) Statistical methods for solar flare probability forecasting. Final report Jun 79-Feb 80. Vecchia, D.F.; Tryon, P.V.; Caldwell, G.A.; Jones, R.H. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). Sep 1980. 82p. NTIS, PC A05/MF A01.

The Space Environment Services Center (SESC) of the National Oceanic and Atmospheric Administration provides probability forecasts of regional solar flare disturbances. This report describes a statistical method useful to obtain 24 hour solar flare forecasts which, historically, have been subjectively formulated. In Section 1 of this report flare classifications of the SESC and the particular probability forecasts to be considered are defined. In Section 2 we describe the solar flare data base and outline general principles for effective data management. Three statistical techniques for solar flare probability forecasting are discussed in Section 3, viz, discriminant analysis, logistic regression, and multiple linearregression. We also review two scoring measures and suggest the logistic regression approach for obtaining 24 hour forecasts. In Section 4 a heuristic procedure is used to select nine basic predictors from the many available explanatory variables. Using these nine variables logistic regression is demonstrated by example in Section 5. We conclude in Section 6 with band broad suggestions regarding continued development of objective methods for solar flare probability forecasting.

32604 Model of the formation of spherical galaxies. Brown, W.K. (Los Alamos Scientific Lab., NM (USA)). *Astrophysics and Space Science ;* **72**: No. 1, 15-31(Sep 1980).

Galactic mass distributions produced by the fragmentation model (in addition to those published previously) are examined. This is done by allowing the cubical fragment to assume any orientation in space. All distributions examined closely resemble observed galactic luminosity profiles, and, among the variety produced, was found the special log I versus rsup(1/4) behaviour of the Vaucoulers' empirical law as well as the exponential behaviour of spirals. Because of the apparent success of the model, the initial conditions and analytical methods are re-examined in detail.

32605 (LA—8931-MS) Radiative transfer approximations in stellar pulsation theory. Davis, C.G. (Los Alamos Scientific Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 26p. NTIS, PC A06/MF A01. Order Number DE81030513.

Pulsation theory is discussed in light of recent improvements in the theory of radiative transfer and hydrodynamics with applications to Cepheids, RR Lyrae, and W Virginis stars.

32606 (PB—81-110025) Solar-geophysical data number 431, July 1980. Part II (comprehensive reports). Data for January 1980, June 1979 and miscellanea. Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Jul 1980. 78p. NTIS, PC A05/MF A01.

In addition to an index for 1979-1980, this issue of comprehensive reports provides data for January 1980 on: solar radio emission and solar X-ray radiation. Solar flare data, 13 months from date of observations, are published in this issue. The 13-month delay will be continued until Solar Cycle 21 passes well through its maximum. The Abbreviated Calendar Record will be suspended indefinitely. After the section on Solar Flares for June 1979, the Miscellaneous data consists of May 1979 Regional Flare Index, Active Regions Oct 6-Nov 3, 1979, and Synoptic Solar Maps Oct 6-Nov 3, 1979.

32607 Grand unification magnetic monopoles inside the earth. Carrigan, R.A. Jr. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nature (London) ;* **288**: No. 5789, 348-350(27 Nov 1980).

Elementary particle grand unification theories admit the possibility of very massive magnetic monopoles, but standard cosmology gives too many poles. Massive monopoles are affected both by gravity and magnetism, requiring reassessment of existing monopole searches. Monopoles inside the earth would be able to annihilate with each field reversal, thereby giving rise to additional internal heat. This perspective is used to estimate an upper limit for the monopole-to-baryon ratio at accretion of 10^{-28}.

32608 **Nitrogen isotope fractionations in the Fischer-Tropsch synthesis and in the Miller-Urey reaction.** Kung, C.C. (Chicago Univ., IL (USA). Dept. of Chemistry); Hayatsu, R.; Studier, M.H. (Argonne National Lab., IL (USA). Chemistry Div.); Clayton, R.N. (Chicago Univ., IL (USA). Enrico Fermi Inst.; Chicago Univ., IL (USA). Dept. of Chemistry; Chicago Univ., IL (USA). Dept. of Geophysical Sciences). *Earth and Planetary Science Letters ;* **46**: No. 1, 141-146(Dec 1979).

Nitrogen isotope fractionations have been measured in Fischer-Tropsch and Miller-Urey reactions in order to determine whether these processes can account for the large $^{15}N/^{14}N$ ratios found in organic matter in carbonaceous chondrites. Polymeric material formed in the Fischer-Tropsch reaction was enriched in ^{15}N by only 3 promille relative to the starting material (NH_3). The ^{15}N enrichment in polymers from the Miller-Urey reaction was 10-12 promille. Both of these fractionations are small compared to the 80-90 promille differences observed between enstatite chondrites and carbonaceous chondrites. These large differences are apparently due to temporal or spatial variations in the isotopic composition of nitrogen in the solar nebula, rather than to fractionation during the production of organic compounds.

6402 Atmospheric Physics

32609 **(AD-A—092568) Scale sizes and lifetimes of f region plasma cloud striations as determined by the condition of marginal stability. Memorandum report.** McDonald, B.E.; Ossakow, S.L.; Zalesak, S.T.; Zabusky, N.J. (Naval Research Lab., Washington, DC (USA)). 17 Nov 1980. 42p. NTIS, PC A03/MF A01.

The two dimensional integrated Pedersen conductivity model for F region plasma cloud striation development may be cast in dimensionless form. The result implies that a structure's stability against bifurcation depends upon whether a diffusion parameter R exceeds a critical value. The critical R for striations is determined by high resolution computer simulation for conductivity ratios M from 2 to 30. Our results combined with electron diffusivity of order 1 square meter/sec agree with observed minimum scale sizes of 15 meters. For turbulent diffusivity of order 100 square meter/sec, our results agree with frequent observations of kilometer-scale structures which 'freeze up' and last for times of order 10000 seconds. This lifetime is also predicted by our results.

32610 **(PB—81-855066) Whistlers and dawn chorus. January, 1974-May, 1980 (citations from the International Aerospace Abstracts Data Base). Report for Jan 74-May 80.** Ogushwitz, H.L. (New England Research Application Center, Storrs, CT (USA)). Aug 1980. 183p. NTIS PC N01/MF N01.

Research studies and articles cited in this bibliography discuss such topics as Whistler waves in finite plasma, Whistler atmospherics, and Whistler modes in the magnetosphere. (Contains 200 citations.)

32611 **(PB—81-855074) Whistlers and dawn chorus. June, 1970-June, 1980 (citations from the Engineering Index Data Base). Report for Jun 70-Jun 80.** Ogushwitz, H.L. (New England Research Application Center, Storrs, CT (USA)). Aug 1980. 99p. NTIS PC N01/MF N01.

Research studies and articles cited in this bibliography discuss such topics as Whistler waves in finite plasma, Whistler atmospherics, and Whistler modes in the magnetosphere. (Contains 100 citations.)

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 32315, 32343

32612 **(AD-A—092683) Kinetic processes in high pressure gases: excited state collisions. Technical report Dec 79-Dec 80.** Schearer, L.D.; McFarland, R.H. (Missouri Univ., Rolla (USA). Dept. of Physics). 1 Dec 1980. Contract N00014-75-C-0477. 30p. NTIS, PC A03/MF A01.

A nitrogen-pumped dye laser system has been used to investigate the 3(2P) yields n(2)D(3/2), (5/2) and 3(2P)(1/2), 3-2 yields n(2)S(1/2) ($6 < or = n < or = 22$) line profiles for sodium perturbed by .2 to 2 Amagats of argon. Sodium was ionized in a stepwise process which incorporated one of the above resonant transitions as an intermediate step. The relative ion yield was determined as a function of laser wavelength and the resulting data analyzed to obtain absorption profiles and line shifts for nd, ns yields 3p transitions. We report the total Penning ionization cross sections for He(2(3)S(1)) atoms incident on Cd and Zn. The measurements are made for relative collision velocities above thermal by using a beam. Previous metal vapor studies of Cd and Zn have been confined to thermal velocities in pulsed after-glow experiments. We also report the observation of HgBr(B-X) fluorescence resulting from collisions of HgBr2 with a vibrationally excited beam of nitrogen molecules in the A(3) sigma (+) (mu) electronic state.

32613 **(AD-A—092754) Theoretical investigation of atomic structure and scattering processes.** Spruch, L.; Rosenberg, L. (New York Univ., NY (USA). Dept. of Physics). Nov 1980. Contract N00014-76-C-0317. 7p. NTIS, PC A02/MF A01.

One area explored is the use of intense laser beams in interaction with atomic systems; the interaction of the projectile and target in a scattering problem with the laser beam is accounted for. We have further explored the applicability of variational methods in general scattering processes.

32614 **(BNL—29448) Coulomb explosion of large penetrating molecular clusters.** Wegner, H.E.; Thieberger, P. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 40p. (CONF-810152—1). NTIS, PC A03/MF A01. Order Number DE81025866.

From Informal workshop on the penetration of exotic particles in matter; New York, NY, USA (8 Jan 1981).

The main purpose of these Coulomb explosion measurements is to determine what kind of structure these and other complex molecules may have and also to determine what other special phenomena may come into play as these complex molecules pass through matter. Although the first preliminary measurements involving the Coulomb explosion of these molecules was reported at this workshop last year, the results are briefly summarized before going on to the more recent measurements obtained with a completely new kind of detector system. This new image intensifier detector system, coupled with a microcomputer, has proven to be a valuable tool in the study of the Coulomb explosion of complex molecules that penetrate matter. In the future, with some additional improvements in the system, and much better statistics for most of the molecules studied to date, it is expected that much new information will be gained about the structure of many kinds of complex molecular ions including the special effects that may be encountered when these fast molecular ions penetrate matter.

32615 **(CONF-8008120—1) Continuum capture in the three-body problem.** Sellin, I.A. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1980. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01. Order Number DE81025467.

From 7. international conference on atomic physics; Cambridge, MA, USA (4 Aug 1980).

The three-body problem, especially the problem of electron capture to the continuum in heavy particle collisions is reviewed. Major topics covered include: second born-induced asymmetry in electron capture to the continuum; historical context, links to other tests of atomic scattering theory; experiments characterizing the velocity distribution of ECC electrons; other atomic physics tests of high velocity Born expansions; atom capture; capture by positrons; and pion capture to the continuum. (GHT)

32616 **(DOE/ER/01198—1362) Coherent bremsstrahlung and channeling radiation from electrons of one to three MeV in silicon and gold.** Watson, J.E. (Illinois Univ., Urbana (USA). Dept. of Physics). 1981. Contract AC02-76ER01198. 105p. NTIS, PC A06/MF A01. Order Number DE81029490.

Thesis.

The observation of sharp peaks in the x-ray spectrum from 1 to 3 MeV electrons striking thin single crystals of silicon and gold is reported. These peaks were observed in the range 1 to 25 keV. The peaks are of two different origins, both direct results of the periodic nature of the target crystals. The first kind of radiation is caused by the interference of incoming and scattered electron wave functions. Because of the periodicity of the target material there is a coherence effect for certain bremsstrahlung wave vectors. This coherent bremsstrahlung, though well known at very high electron energies, has never been adequately studied at electron energies below several hundred MeV. Detailed agreement between theoretical prediction and observation in silicon is shown. The second kind of radiation is caused by electrons channeled along major crystal axes. The electrons enter certain quantized orbits as they channel and may emit photons as a consequence of transitions between the various orbits. Observations of channeling radiation for various crystal axes in silicon are presented. Both phenomena were observed in gold, the first such observation for any metallic target.

32617 (DOE/ER/03244—T3) **Exotic atoms, K-nucleus scattering and hypernuclei.** Barnes, P.D. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics). 1981. Contract AS02-76ER03244. 18p. (COO—3244-84; CONF-810747—2). NTIS, PC A02/MF A01. Order Number DE81027957.

From 9. international conference on high energy physics and nuclear structure; Versailles, France (6 Jul 1981).

Recent progress in exotic atom physics, kaon-nucleus scattering, and hypernuclear physics is reviewed. Specific problems discussed include searches for muon-nucleon interactions beyond QED, a comparison of data and recent calculation of K^{+-} + ^{12}C elastic and inelastic scattering, as well as recent studies of Σ and Λ hypernuclei including new data on the level structure of $^{13}C/\Lambda$.

32618 (DOE/ER/04694—T1) **Low-energy ion-molecule reaction dynamics and chemiionization kinetics. Progress report, February 1, 1981-January 31, 1982.** Farrar, J.M. (Rochester Univ., NY (USA)). 1981. Contract AS02-78ER04694. 8p. (COO—4694-4). NTIS, PC A02/MF A01. Order Number DE81030040.

This progress report concerns work completed or initiated since our last report in October of 1980. We have performed experiments in two major areas: photodissociation of organic cations to study the competition between isomerization and fragmentation; and, low energy proton transfer reactions of HCO^+ with selected neutrals. The former area provides a sideline to our combustion studies of proton transfer in hydrocarbon flames, but the question of energy transfer in highly excited gas phase ions impacts directly upon questions closely related to the fate of ions in combustion. The latter area, currently in progress, focuses upon the dynamics of biomolecular reactions of direct relevance to combustion.

32619 (LA—8835C, pp 35-56) **Formation and properties of mesonic atoms.** Daniel, H. (Technical Univ. of Munich, Germany). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

The review presents: a short survey on mesonic atoms while existing or being annihilated; slowing down theory and coulomb capture; the cascade; experimental results on n(w); experimental results on coulomb capture; experimental results on hydrogen containing targets; experimental results on cascades and intensity patterns from hydrogen-free targets; and applications for non-destructive chemical analysis. (GHT)

32620 (LA—8835C, pp 321-327) **NC-3 mesonic atoms. Summary report and recommendations from panel.** Naumann, R.A. (Princeton Univ., NJ); Knight, J.D. May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Mesonic atom research, the study of the formation and properties of atoms containing an exotic negative particle, has achieved noteworthy progress in the past few years. Experiments have progressed from the exploratory, broad survey type to those that seek exact answers to specific questions. The superior fluxes of stopping beams with well-defined energy provided by the meson factories now permit both the accumulation of data of higher accuracy and the mounting of more probing experiments. Theoretical studies, meanwhile, are treating the phenomena of mesonic atoms on a more realistic basis. These encouraging trends provide a foundation for significant future developments. These panel sessions dealt with theory and experiment related to (1) the initial meson capture process, and (2) the subsequent intraatomic (or molecular) cascade. Applications and some specific experimental techniques bearing on both chemical and nuclear reactions were presented and discussed.

32621 (LA—8835C, pp 378-389) **Production and application of slow and very slow muons. Appendix B.** Daniel, H. (Technical Univ. of Munich, Germany). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Production and application of slow muons (1 MeV > E/sub μ/ > m/sub μ/$(\alpha c)^2$/2) and very slow muons (E/sub μ/ < m/sub μ/$(\alpha c)^2$/2) are discussed. A set-up to increase the flux, consisting basically of a magnet and a wedge, is presented. Typical results are given.

32622 (LBL—12686) **LBL EBIS test-strand.** Feinberg, B.; Brown, I.G. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 19p. (CONF-810579—3). NTIS, PC A02/MF A01. Order Number DE81028125.

From 2. workshop on EBIS and related topics; Saclay, France (12 May 1981).

An EBIS program was initiated at Lawrence Berkeley Laboratory in late 1979. This first stage, construction of an EBIS research and development test-stand is described, along with results of the bare beam experiments.

32623 (LBL—12982) **Effects of reagent translational and vibrational energy on the dynamics of endothermic reactions.** Krajnovich, D.; Zhang, Z.; Huisken, F.; Shen, Y.R.; Lee, Y.T. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 15p. (CONF-810754—1). NTIS, PC A02/MF A01. Order Number DE81028122.

From 12. IPEAC international conference on the physics of electronics and atomic collisions; Gatlinburg, TN, USA (15 Jul 1981).

The endothermic reactions Br + $CH_3I \rightarrow CH_3$ + IBr (ΔH_0° = 13 kcal/mole) and Br + $CF_3I \rightarrow CF_3$ + IBr (ΔH_0° = 11 kcal/mole) have been studied by the crossed molecular beams method. Detailed center-of-mass contour maps of the IBr product flux as a function of recoil velocity and scattering angle are derived. For both systems it is found that the IBr product is sharply backward scattered with respect to the incident Br dirction, and that most of the available energy goes into product translation. Vibrational enhancement of the Br + CF_3I reaction was investigated by using the infrared multiphoton absorption process to prepare highly vibrationally excited CF_3I. At a collision energy of 31 kcal/mole (several times the barrier height), reagent vibrational energy appears to be less effective than an equivalent amount of (additional) translational energy in promoting reaction. More forward scattered IBr is produced in reactions of Br with vibrationally hot CF_3I.

32624 (LBL—13124) **Role of energy exchange in vibrational dephasing processes in liquids and solids.** Marks, S. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 171p. NTIS, PC A08/MF A01. Order Number DE81029819.

Thesis.

Three theories which claim relevance to the dephasing of molecular vibrations in condensed phase matter are presented. All of these theories predict (in certain limiting cases) that the widths and shifts of molecular vibrations will obey an Arrhenius temperature dependence. The basic tenets of the theories are detailed so that the differences between them may be used in an experiment to distinguish between them. One model, based on intermolecular energy exchange of low-frequency modes, results in dephasing the high-frequency modes when anharmonic coupling is present. A computer analysis of temperature dependent experimental lineshapes can result in the extraction of various parameters such as the

anharmonic shifts and the exchange rates. It is shown that, in order to properly assess the relative validity of the three models, other evidence must be obtained such as the spectral parameters of the low-frequency modes, the combination bands, and the isotopic dilution behavior. This evidence is presented for d_{14}-durene (perdeutero-1,2,4,5-tetramethylbenzene) and compared to previous data obtained on pure h_{14}-durene. An extension of the (HSC) intermolecular energy exchange model which allows for the possibility of partial delocalization of the low-frequency modes gives an adequate description of the experimental evidence. Isotopic dilution experiments, in particular, have resulted in a detailed picture of the energy transfer dynamics of the low-frequency modes. A section in which some spontaneous Raman spectra support a model of inhomogeneous broadening in liquids based on results of picosecond stimulated Raman spectroscopy is presented. The model is that a distribution of environmental sites is created by a distribution in the local density and thus creates inhomogeneous broadening.

32625 **(PNL-SA—9306) Continuum electron emission in heavy ion: atom collisions.** Toburen, L.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 57p. (CONF-810392—1). NTIS, PC A04/MF A01. Order Number DE81028234.

From Seminar on high energy ion-atom collision processes; Debrecen, Hungary (17 Mar 1981).

The measurement of energy losses of heavy ions in molecular targets is reviewed. Topics covered include ionization by protons, ionization by helium ions, and ionization by carbon impact. An appendix gives a data compilation of ejected electron energies and ejected electron energies and ejection angles for proton collision with H_2, He, Ne, Ar, Kr, Xe, N_2, O_2, H_2O, CH_4, C_2H_2, C_2H_4, C_2H_6, C_6H_6, NH_3, CH_3NH_2, $C_2H_5NH_2$, SF_6, and TeF_6. Double differential cross-sections are included for several ion-molecule collisions. (GHT)

32626 **(SAND—81-8608) Raman-scattering gas temperature measurements in particle-laden flows.** Flower, W.L. (Sandia National Labs., Livermore, CA (USA)). Jul 1981. Contract AC04-76DP00789. 21p. (CONF-810607—13). NTIS, PC A02/MF A01. Order Number DE81029621.

From Symposium on instrumentation and control for fossil energy processes; San Francisco, CA, USA (8 Jun 1981).

The feasibility of making time-averaged Raman-scattering temperature measurements in highly luminous flows has been investigated in tests on the Sandia Atmospheric Combustor Exhaust Simulator facility (ACES). In these experiments the diluted exhaust stream from a methane-burning combustor was seeded with 5 μm diameter fly ash particles. Tests were run at temperatures ranging from 900 to 1450°K at particle densities up to 6000 particles/cm^3. Measurements were made using a pulsed argon-ion probe laser and a gated detection system for enhancement of signal-to-background ratio. Scans of the Stokes Q-branch vibrational Raman spectrum of nitrogen were fit by calculated spectra in order to determine temperature. The Raman-scattered signal was small but measurable in all cases. There was no apparent laser-induced interference from either fluorescence or particle incandescence. Good agreement between Raman-scattering temperature measurements and radiation-corrected thermocouple mearurements was obtained.

32627 **(UCRL—15384) Parameterization of the bremsstrahlung spectrum.** Feng, I.J.; Pratt, R.H. (Lawrence Livermore National Lab., CA (USA); Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy). 31 Aug 1981. Contract W-7405-ENG-48. 52p. NTIS, PC A04/MF A01. Order Number DE81029739.

Portions of document are illegible.

A parameterization is provided for the bremsstrahlung spectrum in the incident electron energy range 10 to 500 keV for all elements, with particular emphasis on the range 20 to 100 keV for Z = 41 to 92. A general accuracy of 20% is achieved, with 50% in the worst cases, in most ranges utilizing simple one variable functions.

6404 Fluid Physics

32628 **(DOE/ET/27225—15) Physics of two-phase flow: choked flow.** Maeder, P.F.; DiPippo, R.; Delor, M.; Dickinson, D. (Brown Univ., Providence, RI (USA). Div. of Engineering). May 1981. Contract AC02-79ET27225. 47p. NTIS, PC A03/MF A01. Order Number DE81025722.

It is shown that the basic equations governing the flow of a two-phase fluid, i.e., liquid and vapor, are natural extensions of those equations that describe single-phase flow. The exact form of the equations depends on the particular assumptions used to characterize the two-phase flow, i.e., the equations depend on the model chosen. In general the mathematical model is selected so as to retain as much of the physics of the phenomena as possible while at the same time permitting solutions to be obtained without undue complexity. The following quantities were computed for saturated water substance over the temperature range 100 to 250°C and for saturated Refrigerant -114 over the range -20 to +70°C: choking velocity, critical or choking flow density, and saturation properties. Tables of the results are given along with graphs of selected functions.

32629 **(LBL—12322) Extension of Glimm's method to the problem of gas flow in a duct of variable cross-section.** Fok, S.K. (Lawrence Berkeley Lab., CA (USA)). Dec 1980. Contract W-7405-ENG-48. 119p. NTIS, PC A06/MF A01. Order Number DE81029856.

Thesis.

Various numerical methods for extending Glimm's scheme to solve a nonlinear hyperbolic system of partial differential equations in one space variable of the form anti u/sub t/ + anti f/sub x/ (anti u) = anti g (anti x,u) are described. The reason for considering Glimm's scheme rather than some finite difference schemes is because of its ability to pick out the correct weak solution of a given hyperbolic system of partial differential equations without requiring it to be written in conservation form. The numerical schemes we shall look at are (1) Generalized Glimm's scheme, (2) Glimm's scheme with Sod's operator splitting method, and (3) Liu's scheme. In particular, the inhomogeneous Burgers' equation and the problem of radial symmetric gas flow will be studied, and Sod's operator splitting method will be seen to be best among the three numerical schemes. Finally, gas flow in a duct of variable cross-section is discussed together with the classical Chisnell's formula which describes the changes in the speed of the shock with respect to the varying cross-sectional area. It will be shown that incorporating Chisnell's formula into Glimm's scheme (with operator splitting) and Liu's scheme can be done easily; moreover, the resulted schemes are best in treating shock propagation problem in a duct of monotonically decreasing and increasing cross-sectional area respectively. Thus, the case of a variable area duct can be handled by hybridizing Glimm's scheme (with operator splitting and Chisnell's formula) and Liu's scheme (with Chisnell's formula).

6450 High Energy Physics

32630 **(LBL—91-Rev.5-81) Compilation of current high-energy physics experiments.** Wohl, C.G.; Kelly, R.L.; Armstrong, F.E. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 32p. NTIS, PC E02/MF A01. Order Number DE81028585.

Includes 1 sheet of 48x reduction microfiche.

This is the fourth edition of the compilation of current high energy physics experiments. It is a collaborative effort of the Berkeley Particle Data Group, the SLAC library, and nine participating laboratories: Argonne (ANL), Brookhaven (BNL), CERN, DESY, Fermilab (FNAL), the Institute for Nuclear Study, Tokyo (INS), KEK, Serpukhov (SERP), and SLAC. The compilation includes summaries of all high energy physics experiments at the above laboratories that (1) were approved (and not subsequently withdrawn) before about April 1981, and (2) had not completed taking of data by 1 January 1977. Only approved experiments are included.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 32619, 32648, 32662, 32665, 32668

32631 (BNL—29774) Hypernuclei and interactions of kaons with nuclei. Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 18p. (CONF-810747—1). NTIS, PC A02/MF A01. Order Number DE81028467.

From 9. international conference on high energy physics and nuclear structure; Versailles, France (6 Jul 1981).

Recent experimental and theoretical progress in hypernuclear physics is reviewed. Different models for hyperon-nucleus central and spin-orbit potentials are compared: several models yield a very small spin-orbit strength for the Λ, as experimentally observed, but differ considerably in their predictions for the Σ. The new data on the ^{13}C hypernuclear spectrum, as obtained in the (K^-, π^-) strangeness exchange reaction at 800 MeV/c, are discussed. It is shown how one extracts constraints on the Λ-nucleus and effective Λ-nucleon ineractions from the data. The new BNL data on the (K^-, π^+) reaction at 720 MeV/c, leading to Σ-hypernuclear states, are examined. The case of $^6Li(K^-, \pi^+)^6H$ is discussed in some detail, and some speculations concerning the (K^-, π^+) reaction on other targets are presented. The physical mechanisms which may lead to unusually narrow Σ excitations in some systems are examined. Finally, the physics motivations for several future hypernuclear experiments which are already under development, such as $(K^-, \pi^-\gamma)$ and π^{+-}, $K^+)$ studies, or under preliminary consideration, for instance, the (K^-, K^+) reaction producing S=-2 hypernuclei are reviewed.

32632 (DOE/ER/02009—T1) Technical progress report of the Indiana University High-Energy-Physics Group, December 1, 1980-November 30, 1981. Brabson, B.B.; Crittenden, R.R.; Dzierba, A.R.; Heinz, R.M.; Martin, H.J.; Neal, H.A.; Ogren, H.O. (Indiana Univ., Bloomington (USA). Dept. of Physics). 1981. Contract AS02-76ER02009. 23p. (COO—2009-141). NTIS, PC A02/MF A01. Order Number DE81028385.

The Indiana University High Energy Physics Group has been actively involved in a variety of research programs during the current contract year. These programs are associated with major experiments conducted by our group at SLAC, Fermilab and CERN. The physics areas under study include studies of psi meson production in hadron interactions, a study of low-p/sub t/ and high-p/sub t/ collisions utilizing the Multiparticle Spectrometer at Fermilab, and a high resolution study of e^+e^- interactions at high energy at SLAC. The status of the various efforts is discussed within this report.

32633 (DOE/ER/02289—T2) Request for renewal of contract support. Technical progress report, Task B. Block, M.M.; Miller, D.H. (Northwestern Univ., Chicago, IL (USA)). 1981. Contract AC02-76ER02289. 33p. NTIS, PC A03/MF A01. Order Number DE81028305.

Protron-antiproton interactions are being studied at the CERN-ISR to measure total cross sections with a detector which covers almost 4π steradians of solid angle. The apparatus, consisting of the internal hodoscopes, the external hodoscopes, alignment of the apparatus, fast logic and data acquisition, and luminosity measurements are described. Prelininary results are presented. (GHT)

32634 (DOE/ER/03023—26) High energy physics at Tufts University. Progress report. (Tufts Univ., Medford, MA (USA)). 31 Jul 1981. Contract AC02-76ER03023. 97p. NTIS, PC A05/MF A01. Order Number DE81028408.

Research programs in high energy physics at Tufts University are summarized for the year prior to July 1981. The activities of the bubble chamber group, photon group, and theory group are reviewed. (GHT)

32635 (DOE/ER/03072—T4) Research highlights under Contract DE-AC02-76ER03072, February 1, 1981-July 31, 1981. Shoemaker, F.C. (Princeton Univ., NJ (USA). Joseph Henry Labs.). 1981. Contract AC02-76ER03072. 5p. NTIS, PC A02/MF A01. Order Number DE81028488.

Research projects are highlighted including: a study of rare muon induced reactions; a search for eta/sub c/ mesons; hadronic production of charmed particles; production of high-mass dimuons by pions; forward production of massive particles; the crystal ball project at SPEAR; parallel plate avalanche chamber development; and tests of quantum mechanics. (GHT)

32636 (DOE/ER/03130—T3) Research program in experimental high energy physics. Progress report, January 1, 1981-December 31, 1981. Task C. Lanou, R.E. Jr. (Brown Univ., Providence, RI (USA)). 30 Jul 1981. Contract AC02-76ER03130. 53p. (COO—3130-TC-6). NTIS, PC A04/MF A01. Order Number DE81028056.

An experimental program in strong and electro-weak interaction physics of elementary particles is being carried out using electronic detection techniques. Experiments have been performed or have been proposed utilizing the accelerators of the laboratories at Brookhaven, Fermilab, LAMPF, and SLAC. The experiments described in this report by the Electronic Detector Group include the following: (1) studies of inclusive scattering in hadron reactions at Fermilab, (2) experiments to measure neutrino-electron, other neutral current phenomena and neutrino oscillations at the BNL-AGS, and (3) development of a muon polarimeter and proposals for its use in further experiments, (4) studies for experiments at ISA-BELLE and the FNAL anti PP Collider

32637 (DOE/ER/03539—T1) Experimental investigations in particle physics at intermediate energies. Progress report, December 1, 1980-November 30, 1981. Auerbach, L.B.; Highland, V.L.; McFarlane, W.K. (Temple Univ., Philadelphia, PA (USA). Dept. of Physics). Jul 1981. Contract AS02-76ER03539. 12p. (COO—3539-16). NTIS, PC A02/MF A01. Order Number DE81027954.

Data-taking on the pion-beta-decay measurement and substantial progress in its analysis are reported. The low-energy anti pp annihilation cross section experiment is near completion. Planning for a new pi-zero-to-three-gamma experiment at LAMPF is complete. The proposal to use the LEAR facility at CERN for further anti pp work has been approved, and some contributions to the preparation of a neutrino experiment proposal at LAMPF.

32638 (LA—8835C) Intermediate-energy nuclear chemistry workshop. Butler, G.W.; Giesler, G.C.; Liu, L.C.; Dropesky, B.J.; Knight, J.D.; Lucero, F.; Orth, C.J. (Los Alamos National Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 415p. (CONF-8006181—). NTIS, PC A18/MF A01. Order Number DE81026797.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

This report contains the proceedings of the LAMPF Intermediate-Energy Nuclear Chemistry Workshop held in Los Alamos, New Mexico, June 23-27, 1980. The first two days of the Workshop were devoted to invited review talks highlighting current experimental and theoretical research activities in intermediate-energy nuclear chemistry and physics. Working panels representing major topic areas carried out indepth appraisals of present research and formulated recommendations for future research directions. The major topic areas were Pion-Nucleus Reactions, Nucleon-Nucleus Reactions and Nuclei Far from Stability, Mesonic Atoms, Exotic Interactions, New Theoretical Approaches, and New Experimental Techniques and New Nuclear Chemistry Facilities.

32639 (LA—8835C, pp 11-34) Pion nucleus interactions. Walter, H.K. (Laboratorium fuer Hochenergiephysik der ETH, Zurich, Switzerland). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

The review covers elastic scattering; inelastic, charge exchange, and double charge exchange reactions; quasi-free scattering and absorption; knockout and spallation reactions. (GHT)

32640 (LA—8835C, pp 57-72) **Theories of the pion nucleus interaction.** Gibbs, W.R. (Los Alamos Scientific Lab., NM). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

The basic theory of pion-nucleus interaction is reviewed. Connection is made with recent theories of nuclear matter and the relevance of pion condensation and precursor effects is discussed.

32641 (LA—8835C, pp 73-86) **Theory of precompound reactions and nucleon spectra after pion absorption.** Huefner, J. (Institut fuer Theoretische Physik der Universitaet Heidelberg, Germany). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

A pragmatic approach to nuclear precompound reactions and to the intranuclear cascade after pion absorption is presented. A multiple scattering expansion is proposed. Single collision dominates nuclear precompound reactions. The absorption of the negative pion on two nucleons plus a few nucleon-nucleon collisions can explain the available experimental nucleon spectra in magnitude and shape.

32642 (LA—8835C, pp 87-98) **Current nuclear reaction studies in Japan.** Nishi, T. (Kyoto Univ., Japan). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Several studies of the interaction between pions and complex nuclei which have been performed at the National Institute for High Energy Physics (KEK) in Japan by several nuclear physicists and chemists groups are presented.

32643 (LA—8835C, pp 990144) **Clusters, nucleons, and quarks in intermediate-energy reactions.** Boal, D.H. (Simon Fraser Univ., Burnaby, British Columbia). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Inclusive production of many different hadronic systems, from pions to nuclear fragments with more than forty nucleons, has been intensively studied for several years. The targets have also covered a wide range, from ^{4}He to U, as have the projectiles themselves. Although concentration here is on proton induced reactions, mention is also made of muon, electron, photon, and heavy ion induced reactions.

32644 (LA—8835C, pp 193-215) **Some strange K, π, and γ reactions with nuclei.** Thiessen, H.A. (Los Alamos Scientific Lab., NM). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

This is an introduction to the subject of nuclear physics with strange particles. The puzzle of thirty years ago, namely, strong production cross section and weak decay, was solved by the postulate of a new quantum number, called strangeness, which is conserved in the strong interaction but not in the weak interaction. Strong production is possible if particles are produced in pairs with total strangeness 0. The fact that only negative strangeness baryons exist limits the possible reactions for producing strange nuclei. In particular, the (K^-,π^-) or (π^+,K^+) reactions are the only strong reactions which will produce a Λ in a two-body reaction on a neutron.

32645 (LA—8835C, pp 216-239) **NC-1 pion-nucleus reactions. Summary report and recommendations from panel.** Steinberg, E.P. (Argonne National Lab., IL); Orth, C.J. May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

The program of the NC-1 Panel Sessions is given. Survey talks were presented in the various areas and served as a basis for further discussion. The highlights of the sessions are presented with particular emphasis on the directions indicated as most fruitful and important for future investigations. Two review papers are presented in their entirety as Appendices B and C. Topics include: stopped-pion reactions; fast pions-single nucleon removal reactions; pion charge exchange; pion double charge exchange; pion charge exchange theory; and spallation, fragmentation, and fission with intermediate energy projectiles.

32646 (LA—8835C, pp 328-343) **NC-4 exotic interactions. Summary report and recommendations from panel.** Turkevich, A.L. (Univ. of Chicago, IL); Hungerford, E.V. III. May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

The review includes antiproton-nucleus interactions, the role of mesons in nuclei, neutrino properties and nucleon decay, and interactions of kaons with nuclei.

32647 **(LA—8949-MS) How to build a very low momentum K^- beam at a kaon factory.** Hoffman, C.M. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01. Order Number DE81030420.

Design considerations for the construction of a very low momentum ($\sim$ 400 MeV/c) K^- beam at a high-flux proton accelerator are discussed. Possible uses of such a beam are described.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 32607, 32654, 32655, 32659

32648 **(CONF-810747—3) Dynamics of hadron-nucleus interactions.** Wallace, S.J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jul 1981. Contract AS05-76ER05126. 25p. (ORO—5126-145). NTIS, PC A02/MF A01. Order Number DE81026272.

From 9. international conference on high energy physics and nuclear structure; Versailles, France (6 Jul 1981).

Recent progress in diffraction theory shows that proton-nucleus scattering at nonforward angles is dominated by the interference of waves from two or more bright spots. Analytic formulas based on asymptotic theories of diffraction yield valuable new insights into the scattering and these formulas can be readily extended to illuminate the role of dynamical ingredients, i.e., the nucleon-nucleon amplitudes. The governing parameters of the diffraction and some direct connections between the observed cross sections and the input dynamics are reviewed. New information regarding the nucleon-nucleon parameters based on recent phase shift analyses show some systematic differences from the effective NN amplitudes which produce fits to proton-nucleus diffraction data. Recent progress in understanding the role of Δ-isobars in proton-nucleus dynamics is reviewed. 126 references.

32649 **(DOE/ER/02009—T2) Theoretical particle physics. Progress report, December 1, 1980-November 30, 1981.** Hendry, A.W.; Lichtenberg, D.B.; Weingarten, D.H. (Indiana Univ., Bloomington (USA). Dept. of Physics). Jun 1981. Contract AS02-76ER02009. 35p. (COO—2009-142). NTIS, PC A03/MF A01. Order Number DE81027974.

During the last year, the group has worked on a variety of phenomenological and theoretical problems in elementary particle physics. The quark model was applied to the study of mesons and baryons, the structure of nucleon-nucleon scattering was examined, work continued in lattice gauge theory, and scaling was examined in a model field theory.

32650 **(DOE/ER/03130—T6) Progress report for a research program in theoretical high-energy physics.** Feldman, D.; Fried, H.M.; Guralnik, G.S.; Jevicki, A.; Kang, K.; Tan, C.I. (Brown Univ., Providence, RI (USA). Dept. of Physics). 31 Jul 1981. Contract AC02-76ER03130. 20p. (COO—3130TA-354). NTIS, PC A02/MF A01. Order Number DE81025721.

This year's research has dealt with a wide range of topics in High-Energy Theoretical Physics. New results have been found in: group-contracted field theories; an effective potential in a model of lepton/quark generations, and causal Green's functions in arbitrary external fields; solutions to the N-body, Coulomb scattering prob-

lem, and a new, non-perturbative formulation of QCD; the phase structure of the Potts model in the large-N expansion, and lattice gauge-matter systems at finite temperature; the renormalization and parametrization of strong-coupling techniques, and special properties of certain two-dimensional nonlinear σ-models; a loop-space reformulation of QCD via collective field methods, and the description of U(N) gauge theories as N-body problems in loop space; the problems of horizontal flavor mixing, and the neutrino mass in grand unified schemes; the masterfield approach to two-dimensional QCD, and the existence of a hitherto unsuspected vacuum state; relations between cut-off lambda-parameters in lattice- and continuum-regulated field theories, and roughening phenomena for the lattice interquark potential; and the first, complete solution to the Migdal-Makeenko equation for a three-dimensional lattice system, and the phase diagram for QCD with fixed N/sub f//N/sub c/ in the large-N limit of the one-plaquette model.

32651 **(DOE/ER/03992—439) Comments on QCD confinement, DTU model, and hadron-nucleus collisions.** Chiu, C.B. (Texas Univ., Austin (USA). Dept. of Physics). Apr 1981. Contract AS05-76ER03992. 15p. (CONF-810390—1). NTIS, PC A02/MF A01. Order Number DE81028452.

From Europhysics study conference on partons in soft-hadronic processes; Erice, Italy (8 Mar 1981).

Complementary discussions on the QCD flux tube model and the DTU model in connection with our previous work are given. It is also shown that the recent hadron-nucleus collision model has two important suppression mechanisms for particle production. Within the projectile cascade approximation, the model leads to the prediction of approximate anti ν universality.

6453 Particle Invariance Principles And Symmetries

32652 **(DOE/ER/03066—T1) Spontaneous breaking of CP in SU(5), natural flavor conservation and the baryon asymmetry.** Nieves, J.F. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). Jun 1981. Contract AC02-76ER03066. 22p. (COO—3066-170). NTIS, PC A02/MF A01. Order Number DE81027992.

An SU(5) model is presented in which CP is spontaneously broken at the grand unification mass scale and that preserves all the features of the Weinberg model of CP-nonconservation with natural flavor conservation. Therefore, in contrast to a model recently proposed by Branco, in the present model a net cosmological baryon asymmetry can be generated through the decays of superheavy lliggs. The implications for CP-nonconserving effects in proton decay are also discussed.

6454 Field Theory

REFER ALSO TO CITATION(S) 32617

32653 **(LBL—12872) Polynomial chromodynamics.** Ruck, H.M. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 6p. (CONF-8105104—6). NTIS, PC A02/MF A01. Order Number DE81028038.

From 5. high energy heavy ion study; Berkeley, CA, USA (18 May 1981).

A model of classical field theory with internal symmetry Z(3) is partially solved in 1 + 1 dimensions. The dynamical variables are two pairs of scalar and spinor fields phi_1, phi_2 and psi_1, psi_2. The phi and psi fields form composite finite-size particles. The mass spectrum and the interactions of these particles is studied.

32654 **(SLAC-PUB—2762) Exclusive processes in quantum chromodynamics.** Brodsky, S.J.; Lepage, G.P. (Stanford Linear Accelerator Center, CA (USA); Cornell Univ., Ithaca, NY (USA). Lab. of Nuclear Studies). Jun 1981. Contract AC03-76SF00515. 26p. (CONF-810368—4). NTIS, PC A03/MF A01. Order Number DE81028233.

From Conference on perturbative quantum chromodynamics; Tallahassee, FL, USA (25 Mar 1981).

Large momentum transfer exclusive processes and the short distance structure of hadronic wave functions can be systematically analyzed within the context of perturbative QCD. Predictions for meson form factors, two-photon processes $\gamma\gamma \rightarrow$ M anti M, hadronic decays of heavy quark systems, and a number of other related QCD phenomena are reviewed.

6455 Scattering Theory

32655 **(UCRL—20114) Absorption corrections and multiple scattering in the K-matrix formalism.** Joachain, C.J.; Risk, C. (California Univ., Berkeley (USA). Dept. of Physics; California Univ., Berkeley (USA). Lawrence Radiation Lab.). [nd]. Contract W-7405-ENG-48. 24p. Dep. NTIS, PC A02/MF A01. Order Number DE81026845.

The K-matrix formalism is used to derive the absorption model and to reconcile absorption and rescattering corrections in high-energy hadronic two-body collisions. Detailed calculations are made in the case of elastic proton-proton scattering, for which the K-matrix approach is compared to the eikonal calculation of Frautschi and Margolis.

65 PHYSICS RESEARCH

6510 Nuclear Physics

32656 **(DOE/ER/03496—T1) Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.** Huizenga, J.R.; Schroeder, W.U. (Rochester Univ., NY (USA). Dept. of Chemistry and Physics). Jul 1981. Contract AS02-76ER03496. 261p. (COO—3496-76). NTIS, PC A12/MF A01. Order Number DE81027980.

Separate abstracts were prepared for the seven papers presented. (WHK)

32657 (DOE/ER/03496—T1, pp 80-106) **Reaction parameters for heavy-ion collisions.** Wilcke, W.W.; Birkelund, J.R.; Wollersheim, H.J.; Hoover, A.D.; Huizenga, J.R.; Schroeder, W.U.; Tubbs, L.E. (Univ. of Rochester, NY). Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

This table presents reaction parameters for all combinations of 27 projectile and 16 target nuclei in a laboratory bombarding energy range of 1 to 50 MeV/u. The reaction parameters are derived from the Fresnel model of heavy-ion scattering, the droplet model and the rotating liquid drop model or from systematics of experimental data. Only three sample pages of the very extensive table to be published in Atomic Data and Nuclear Data Tables are included.

32658 (DOE/ER/03496—T1, pp 107-132) **Heavy-ion fusion revisited.** Huizenga, J.R.; Birkelund, J.R.; Schroeder, W.U.; Wilcke, W.W.; Wollersheim, H.J. (Univ. or Rochester, NY). Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

Heavy-ion fusion cross sections are presented for a selected number of reactions covering a wide range of Z/sub T/Z/sub p/ values (60 to 3000). For the lighter systems emphasis is placed on the high-energy part of the fusion-evaporation excitation functions. These experimental data are compared with several fusion models in order to test the validity of the various models over a large energy interval. For lighter systems and not too high energies, the fusion process is experimentally rather well distinguishable because of the dominance of compound-nucleus formation. At higher energies and, in particular, for heavier systems, the experimental situation is considerably more intricate. For example, for intermediate systems, fusion-fission competition begins to dominate over fusion-evaporation for angular momenta of approximately 65 h-bar. In addition, there may be a qualitatively distinguished type of fission of partially equilibrated, symmetric or non-symmetric intermediate systems. The experimental fusion-fission cross sections of the very heavy systems are smaller than predicted by a one-dimensional classical dynamical model, indicating that the topology of the underlying potential energy surface of relevance for the fusion process is not well approximated by a barrier in a one-dimensional picture. A

simple model description of fusion inhibition induced by the dynamical evolution along a neck-degree of freedom proposed by Swiatecki is successfully applied to a variety of fusion-fission excitation functions. Detailed dynamical calculations have been performed to study the dependence of dynamical fusion inhibition on pertinent features of the multi-dimensional potential energy surface. 85 references.

32659 **(DOE/ER/13001—T1) Nuclear theory group progress report and renewal proposal, December 1, 1981-November 30, 1984.** Brown, G.E.; Jackson, A.D.; Kuo, T.T.S. (State Univ. of New York, Stony Brook (USA)). 1981. Contract AS02-76ER13001. 115p. NTIS, PC A06/MF A01. Order Number DE81029029.

The work of the Stony Brook Nuclear Theory Group covers a broad range of topics in theoretical nuclear structure. Primary emphasis is placed on understanding the origin of the nucleon-nucleon and meson-nucleon interactions. Phenomenological treatments of QCD, using chiral invariance as a guide, are central to our efforts here; through the chiral bag model they give us also an improved understanding of the structure of hadrons. Starting from the free interaction, many-body techniques have been used to construct the effective interaction between nucleons in nuclei. Analysis of a wide range of nuclear phenomena has been carried out using such effective interactions. Among the most interesting are nuclear giant resonances for which we offer a dynamical theory of nuclear vibrations which emphasizes the energy dependence of the effective interaction. Continuing our earlier description of the collapse of large stars, we have worked out the formation of the shock wave upon bounce, and its progress out through the star. We believe this shock wave to blow off the mantle and envelope of the star, leaving a compact remnant, the pulsar. Computer calculations follow this scenario until the shock is some distance beyond the neutrino sphere, where the shock then runs out of energy. We are extending these calculations to a description of explosive nucleosynthesis. We have also been studying heavy ion reactions. In the low-energy regime, we have concentrated on nuclear quasimolecular states, and on the angular dependence of deep inelastic scattering. In the relativistic regime, we wish to extend our old work on states of dense matter.

32660 (LA—8835C, pp 145-176) **Nuclei far from β-stability: some methods and results.** Epherre, M. (Centre National de la Recherche Scientifique, Orsay, France). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

A few examples are taken from among the studies which are presently being carried out on nuclei far from stability. These examples show how valuable systematic studies of the principal properties of the nuclear ground states of long series of isotopes can be for the nuclear structure knowledge, with the additional possibility of revealing unexpected features. These experiments can be pursued on other elements - laser spectroscopy and nuclear spectroscopy on the unstable K isotopes have now started at ISOLDE and at the PS - to search for technical innovations and new optical methods for studies of the atomic hyperfine structure and a new type of mass spectrometer for mapping the nuclear mass surface with high precision. Finally, upstream of these experiments are the mass spectrometer or mass separator and the proton beam. On-line mass separation is not the only technique to study nuclei away from stability, but it has so far been the best, and intermediate- and high-energy protons have produced higher yields of those nuclei over a wide mass range than any other technique. In particular, high intensity proton beams such as those at meson factories have great promise for this kind of research (provided elaborate radiation precautions are taken). The possibility of moving the ISOLDE facility to SIN is presently being actively studied.

6513 Nuclear Properties And Reactions, A=6-19

32661 **(DOE/ER/02490—2) Study of structure of nuclei with neutrons and nuclear data measurements for MFE. Progress report, September 1, 1980-July 1, 1981.** Lane, R.O. (Ohio Univ., Athens (USA)). 1981. Contract AS02-76ER02490. 73p. NTIS, PC A04/MF A01. Order Number DE81028388.

Measurements of neutron differential elastic and inelastic scattering cross sections have been made for ^{13}C and ^{18}O. For ^{7}Li + n, a multichannel R-matrix analysis has been completed, providing much new structure information for the compound ^{8}Li system. These results are in very good agreement with recent theoretical model calculations, so that together the two provide considerable advancement in the state of our knowledge of ^{8}Li. R-matrix analyses of ^{11}B + n, ^{12}C + n, ^{13}C + n and inelastic scattering data have also been completed. For all three nuclei, comparisons of theoretical results with the R-matrix analysis are made. The triplet quadrupole spectrometer (TQS) is now fully operational. Development of new detectors, techniques, data analysis codes and theoretical model codes for use with the TQS system is complete. Measurements of (n,z) cross sections for fusion reactor structural materials e.g., ^{58}Ni are currently under way. Construction of the long-flight-path tunnel for the swinger magnet facility is complete and the first preliminary test experiment gave very promising results.

32662 (LA—8835C, pp 240-249) **Particles and residual products from the interaction of stopped pions with nuclei. Appendix B.** Pruys, H.S.; Engfer, R.; Isaak, H.P.; Kozlowski, T.; Sennhauser, U.; Walter, H.K.; Zglinski, A. (Univ. of Zurich, Switzerland). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Recently measured yield distributions of residual products and neutron and charged particle spectra from π^- absorption in nuclei are compared with statistical calculations. Upper limits of about 30% can be given for the amount of α-cluster absorption. Model dependent values for the ratio R of np to pp pairs that can absorb the pion are 2.3 +- 0.6 for ^{12}C, 1.1 +- 0.3 for ^{59}Co, and 2.0 +- 0.5 for ^{197}Au.

32663 **(LA—8842-MS) The $^{1}H(^{7}Li,n)^{7}Be$ reaction as a neutron source in the MeV range.** Drosg, M. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01. Order Number DE81030415.

Neutron production in the MeV range by the $^{1}H(^{7}Li,n)^{7}Be$ reaction is attractive for two reasons: (1) emission of neutrons only into a narrow forward cone is very profitable in low-background experiments and (2) the neutron production cross section is very high, especially at lower energies where it reaches 1b/sr. General characteristics of the source are described and the limitations in practical applications are discussed.

32664 **(LA—8891-T) Positive-pion double-charge-exchange reaction: experiments on the isotopic pairs oxygen-16,18 and magnesium-24,26.** Greene, S.J. (Los Alamos National Lab., NM (USA); Texas Univ., Austin (USA). Dept. of Physics). Jun 1981. Contract W-7405-ENG-36. 141p. NTIS, PC A07/MF A01. Order Number DE81028515.

Thesis.

The (π^+,π^-) double-charge-exchange (DCX) reaction has been performed on targets of T = 0,1 isospin (and isotopic) pairs ^{16} ^{18}O and ^{24} ^{26}Mg. Energy excitation functions of d σ/d Ω, across the (3,3) π-N resonance, are presented for transitions to double-isobaric analog state (DIAS) and non-DIAS ground-state residual nuclei. Angular distributions in the region of 5^0 to 33^0 are presented for the DIAS from the T = 1 nuclei. The similarities and differences of DIAS and non-DIAS distributions are discussed in relation to reaction-mechanism and nuclear-structure effects. Also, a simple, two-amplitude model for the ^{18}O excitation function, consistent with the data, is presented. The utility of DCX in nuclear mass measurements is discussed, with some examples.

32665 **(LBL—12623) Theory of Coulomb distortion of pion spectra by heavy-ion spectator fragments.** Rasmussen, J.O.; Radi, H.M.A.; Sullivan, J.P.; Frankel, K.A.; Hashimoto, O. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 7p. (CONF-8105104—7). NTIS, PC A02/MF A01. Order Number DE81028013.

From 5. high energy heavy ion study; Berkeley, CA, USA (18 May 1981).

It has been known for over two years now that the π^- spectrum from heavy ion collisions peaks near beam velocity and that the π^+ spectrum has a corresponding depression. It has been guessed that these features are Coulomb effects of projectile fragments. A theoretical treatment of this phenomena is given, and results are compared with experimental data. (WHK)

32666 **(LBL—12978) Measurement of two-particle correlations in 800 MeV pA collisions.** Tanihata, I.; Miake, Y.; Hamagaki, H.; Kadota, S.; Shida, Y.; Lombard, R.; Moeller, E.; Nagamiya, S.; Schnetzer, S.; Steiner, H. (Lawrence Berkeley Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 6p. (CONF-8105104—2). NTIS, PC A02/MF A01. Order Number DE81028652.

From 5. high energy heavy ion study; Berkeley, CA, USA (18 May 1981).

Two-particle (p-p,p-d) coincidence has been measured in p + A collisions. Production mechanism of backscattered proton has been studied by forward-backward coincidence events. Data show the importance of 2N-cluster scattering and/or multiple scattering processes involving a few nucleons. They also show that the nucleon-nucleon quasi-elastic-scattering is not the dominant part of the backscattered proton production.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 32664

32667 **(CONF-810920—9) Parity of the 398 eV resonance in ^{35}Cl.** Hussein, A.Z.; Raman, S.; Harvey, J.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029665.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The 398 eV resonance in the capture of neutrons by ^{35}Cl is definitely shown to be a p-wave resonance through neutron transmission measurements.

6515 Nuclear Properties And Reactions, A=39-58

32668 **(LBL—12641) Mid-rapidity pion cross sections: new data confront theories.** Frankel, K.A.; Bistirlich, J.A.; Bossingham, R. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 6p. (CONF-8105104—5). NTIS, PC A02/MF A01. Order Number DE81028014.

From 5. high energy heavy ion study; Berkeley, CA, USA (18 May 1981).

Pion production by collisions of relativistic heavy ions has been studied recently by Wolf et al. For the reaction 1.05 GeV/A ^{40}Ar + Ca $\rightarrow \pi^+$, they discovered a peak in the invariant cross section at mid-rapidity at P/sub perpendicular/ $\sim$ 0.5 m/sub π/c. This peak is not apparent in the 730 MeV p^+p data of Cochran et al. and was attributed to possible hydrodynamic flow effects. Several authors have suggested that the π^+ peak is a Coulomb effect. These models predict the π^- would be drawn in towards the fireball, leaving an essentially flat distribution in the mid-rapidity region. Mid-rapidity π^+ and π^- cross sections were measured using a 1.05 GeV/A argon beam with a calcium target. The pions were measured with a magnetic spectrometer set at 15° to the beam and were stopped in a scintillator range telescope. Results are presented and discussed. (WHK)

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 32662

32669 **(CONF-810920—10) Neutron resonance study of ^{86}Kr$^+$.** Fogelberg, B.; Harvey, J.A.; Macklin, R.L.; Raman, S.; Stelson, P.H. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029668.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The level density in ^{87}Kr and the effective capture cross section of ^{86}Kr have been deduced from a neutron resonance study.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 32638, 32638, 32684

32670 **(CONF-810920—11) Anomalous transitions in ^{144}Nd and ^{146}Nd in 2-keV (n,γ) measurements.** McClure, D.A.; Kenny, M.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029671.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

In 2-keV (n,γ) measurements, anomalously strong E1 transitions have been observed to known 2^+ levels in ^{144}Nd and ^{146}Nd.

32671 **(EGG-PHYS—5182) Integral-capture measurements and cross-section adjustments for Nd, Sm, and Eu.** Anderl, R.A.; Schmittroth, F.; Harker, Y.D. (EG and G Idaho, Inc., Idaho Falls (USA); Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1981. Contract AC07-76ID01570. 113p. NTIS, PC A06/MF A01. Order Number DE81029635.

Integral-capture reaction rates are reported for ^{143}Nd, ^{144}Nd, ^{145}Nd, ^{147}Sm, ^{151}Eu, ^{152}Eu, ^{153}Eu, and ^{154}Eu irradiated in different neutron spectra in EBR-II. These reaction rates are based primarily on mass-spectrometric measurements of the isotopic atom ratios of the capture product to the target nuclide. The neutron spectra are characterized using passive neutron dosimetry and spectrum-unfolding with the FERRET least-squares data analysis code. Reaction rates for the neutron spectrum monitors were determined by the radiometric technique using Ge(Li) spectrometers. These rates are also reported here. The integral data for the rare-earth samples and for the spectrum monitors were used in multigroup flux/cross-section adtustment analyses with FERRET to generate adjustments to 47 group representations of the ENDF/B-IV capture cross sections for the rare-earth isotopes. These adjusted cross sections are in good agreement with recent differential data and with adjusted cross sections based on STEK integral data. Examples are given of the use of the adjusted cross sections and covariance matrices for cross-section evaluation.

32672 **(LA—8835C, pp 313-320) NC-2 nucleon-nucleus reactions and nuclei far from stability. Summary report and recommendations from panel.** Korteling, R.G. (Simon Fraser Univ., Burnaby, British Columbia); Butler, G.W. May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

This panel covered two distinctively different topics, nucleon induced reactions and the production and study of nuclei far from stability. This report is therefore divided into these two topics. In addition, the panel joined panel NC-1 for a joint session on pion and proton spallation and fragmentation. As a result, some of the material of that session might appear in both of the reports.

32673 (PNL-SA—9352) Beta-delayed two-neutron decay studies for $^{96-99}$Rb. Reeder, P.L.; Warner, R.A.; Yeh, T.R.; Chrien, R.E.; Gill, R.L.; Liou, H.; Shmid, M.; Stelts, M.L. (Battelle Pacific Northwest Labs., Richland, WA (USA); Cornell Univ., Ithaca, NY (USA); Brookhaven National Lab., Upton, NY (USA)). May 1981. Contract AC06-76RL01830. 16p. (CONF-810649—15). NTIS, PC A02/MF A01. Order Number DE81028093.

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Beta-delayed two-neutron emission from $^{96-99}$Rb has been studied by use of the neutron-neutron time correlation technique. Time interval distributions for neutron pulses from a polyethylene moderated neutron counter were measured for mass-separated sources. Coincident neutrons were identified in the time interval distribution by a component having the characteristic residence time of 35 μs for this counter. At mass 98 a coincidence rate well above the correlated background results in a P/sub 2n/ for ^{99}Rb of 0.057 +- 0.008%. Upper limits(2 sigma) for P/sub 2n/ of 0.004, 0.008, and 0.024% are reported for ^{96}Rb, ^{97}Rb, and ^{99}Rb, respectively.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 32671

32674 (ANL/NDM—56) Fast-neutron interactions with ^{182}W, ^{184}W and ^{186}W. Guenther, P.T.; Smith, A.B.; Whalen, J.F. (Argonne National Lab., IL (USA)). Jun 1981. Contract W-31-109-ENG-38. 143p. NTIS, PC A07/MF A01. Order Number DE81028481.

Neutron total cross sections of ^{182}W, ^{184}W and ^{186}W are measured from ≈ 0.3 to 5.0 MeV at intervals of ≦ 50 keV to accuracies of 1 to 3%. Differential neutron elastic- and inelastic-scattering cross sections of the same three isotopes are measured at scattering angles in the range 20 to 160° and at incident-neutron energy intervals of ≈ 100 keV from 1.5 to 4.0 MeV. Approximately thirty scattered-neutron groups are observed for each of the isotopes. Prominent of these are excitations attributed to collective rotational and vibrational bands. The experimental results are interpreted in terms of optical-statistical and coupled-channels models with particular attention to the direct excitation of ground-state-rotational and β- and γ-vibrational bands. The strengths of the direct interactions and the magnitudes of the collective deformations are inferred from the interpretations and compared with similar values previously reported elsewhere. The experimental results are used to deduce experimentally-based evaluated data sets for ^{182}W, ^{184}W and ^{186}W over the energy range 0.1 - ≈ 5.0 MeV.

32675 (CONF-810920—8) Test of Axel-Brink predictions in the ^{167}Er(n,γ)^{168}Er reaction. Kahane, S.; Slaughter, G.G.; Raman, S. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029670.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

The average radiation widths of primary γ rays in the reaction ^{167}Er(n,γ)^{168}Er are in reasonable agreement with the Axel-Brink predictions based on a giant dipole resonance model.

32676 (DOE/ER/03496—T1, pp 177-252) ^{165}Ho + ^{56}Fe reaction at E/sub lab/ = 462 MeV. Hoover, A.D. (Univ. of Rochester, NY); Birkelund, J.R.; Hilscher, D.; Schroeder, W.U.; Wilcke, W.W.; Huizenga, J.R.; Breuer, H.; Mignerey, A.C.; Viola, V.E. Jr.; Wolf, K.L. Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

The system ^{165}Ho + ^{56}Fe was studied at a bombarding energy of E/sub lab/ = 462 MeV. The experimental Z distributions measured as a function of angle and energy are discussed. The integrated fragment Z distribution of the light reaction fragment is fairly broad and centered close to the charge of the projectile. The kinetic energy distribution extends from the quasi-elastic region down to energies smaller than the Coulomb energy of touching spherical nuclei. The angular distribution is peaked forward of the quarter-point angle and rises at small angles which is interpreted as due to orbiting. Correlations of observed fragment Z distributions with energy loss give an indication of the progress of the reaction. Charge distributions show an average drift towards larger asymmetry and an increase in width with increasing energy damping. Results are presented taking account of the Coulomb barrier for two choices of the scission radius. With the aid of a phenomenological description, the initial angular momenta l/sub i/ and interaction times are deduced. Interaction times are compared to other characteristic times for the reaction as a function of l. Results from a classical dynamical model using proximity formalism and one-body transport are shown for comparison to experimental observables and deduced quantities. The influence of a neck degree of freedom on the calculated trajectories is studied in some detail.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 32662

32677 (DOE/ER/03496—T1, pp 133-176) ^{209}Bi + ^{136}Xe reaction at E/sub lab/ = 1422 MeV. Wollersheim, H.J. (Univ. of Rochester, NY); Wilcke, W.W.; Birkelund, J.R.; Huizenga, J.R.; Schroeder, W.U.; Freiesleben, H.; Hilscher, D. Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

Projectile-like reaction products from the ^{209}Bi + ^{136}Xe reaction were studied at a laboratory bombarding energy of 1422 MeV. The fragments were identified by atomic number, and their kinetic energies and angular distributions were measured using three solid-state ΔE-E telescopes. The strongly damped products exhibit features similar to those seen in two previous measurements of the same reaction at 940 and 1130 MeV. The angular distribution is peaked near the grazing angle. The minimum kinetic energy is bombarding-energy independent and 150 MeV smaller than the Coulomb energy of touching spherical fragments, indicating a large deformation of these dinuclear systems. The measured element distributions for given Q-values are found to be Gaussian and centered at the atomic number of the projectile. At large negative Q-values, the centroids of the Gaussian distributions exhibit a small drift towards charge splits more asymmetric than the initial system. Various correlations between experimental observables, including the variances of the Z-distributions, the centroids of the angular distributions and the Q-values, are interpreted for all three bombarding energies in terms of the proximity one-body transport model. The experimental relations are satisfactorily reproduced by this theory.

6520 Nuclear Properties And Reactions, A=220 And Above

32678 Independent yields of sup(148m)Pm, sup(148g)Pm and ^{150}Pm from fission of ^{235}U and ^{238}U with 14.8 MeV neutrons. Nethaway, D.R.; Richardson, A.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Journal of Inorganic and Nuclear Chemistry ;* **43**: No. 5, 889-893(1981).

Measurements were made of the independent fractional chain yields of sup(148m)Pm, sup(148g)Pm, and ^{150}Pm from fission of ^{235}U and ^{238}U irradiated with 14.8-MeV neutrons. The results for ^{235}U are: sup(148m)Pm, (8.0 +- 0.6) x 10^{-6}; sup(148g)Pm, (1.05 +- 0.13) x 10^{-6}; and ^{150}Pm, (1.79 +- 0.15) x 10^{-3}. Those for ^{238}U are: sup(148m)Pm =< 1.6 x 10^{-7}; sup(148g)Pm =< 1.3 x 10^{-7}; and ^{150}Pm, (2.3 +- 0.7) x 10^{-5}. It was found that the yields are generally smaller than those predicted on the basis of the independent-yield systematics of Nethaway, although they are near the lower end of the predicted range. Values of Zsub(p) inferred from the measured yields average about 0.12 charge unit smaller than the predicted values. The difficulty in estimating yields such as these may be because the actual charge dispersion curve is narrower than assumed, the neutron emission associated with energetically unfavoured charge splits is uncertain, or the reference Zsub(p) function is uncertain in this mass region.

32679 (ORNL/TM—7940) **Absolute measurement of anti ν/sub p/ for ^{252}Cf using the ORNL large liquid scintillator neutron detector.** Spencer, R.R.; Gwin, R.; Ingle, R. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 73p. NTIS, PC A04/MF A01. Order Number DE81030228.

The ORNL large liquid scintillator detector was used in a precise determination of anti ν/sub p/, the number of neutrons emitted promptly, for spontaneous fission of ^{252}Cf. Measurements of the detector efficiency over a broad energy region were made by means of a proton-recoil technique employing the ORELA white neutron source. Monte Carlo calculation of the detector efficiency for a spectrum representative of ^{252}Cf fission neutrons was calibrated with these elaborate measurements. The unusually flat response of the neutron detector resulted in elimination of several known sources of error. Experimental measurement was coupled with calculational methods to correct for other known errors. These measurements lead to an unusually small estimated uncertainty of 0.2% in the value obtained, anti ν/sub p/ = 3.773 +- 0.007.

32680 **Spontaneous fission yields for ^{246}Cm.** Gindler, J.E.; Henderson, D.J.; Glendenin, L.E. (Argonne National Lab., IL (USA)). *Journal of Inorganic and Nuclear Chemistry ;* **43**: No. 5, 895-896(1981).

Cumulative yields for 17 fission products in the spontaneous fission of ^{246}Cm have been determined with γ-ray spectrometry. These yields are compared with those determined in the spontaneous fission of ^{244}Cm and ^{248}Cm.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 32658

32681 (BNL—29809) **M1 transitions in even-even deformed nuclei and the IBA.** Warner, D.D. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 3p. (CONF-810920—7). NTIS, PC A02/MF A01. Order Number DE81028333.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

It is shown that the Interacting Boson Approximation can produce essentially identical results for M1 transitions in deformed even-even nuclei as can be obtained from the geometrical approach, and many comparisons with experiment are already available for the latter in the literature. Since no physical constants are involved in the IBA-1 formalism, it would be useful to use the similarity of the two approaches to obtain a physical description of the IBA constants. Use of the IBA-2 approach might also prove illuminating, since it should identify the contributions of the neutron and proton degrees of freedom, analogous to the method of Greiner. (WHK)

32682 (CONF-8010154—4) **Determination of nuclear-matter temperature and density.** Wolf, K.L. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 58p. NTIS, PC A04/MF A01. Order Number DE81023847.

From Workshop on Future Relativistic Heavy Ion Experiments; Darmstadt, F.R. Germany (7 Oct 1980).

Some of the things learned about nuclear matter under extreme conditions during the past few years in relativistic heavy ion studies are reviewed. Two developments are discussed. The completion of analyses and publication of results from the impact parameter selected, single-particle inclusive experiments have proven to be important. Preliminary results from the new generation of two-particle correlation and particle-exclusive measurements, especially those using streamer chambers, look even more definitive. Also the measurement of more exotic ejectiles with long mean free paths in nuclear matter promises to provide more basic information. Calculations are offering real guidance and are providing explanations of high energy collisions. The Monte Carlo and intranuclear cascade calculations discussed are especially informative.

32683 (DOE/ER/03496—T1, pp 6-18) **Correlated mass and charge transport induced by statistical nucleon exchange in damped nuclear reactions.** Schroeder, W.U. (Univ. of Rochester, NY); Huizenga, J.R.; Randrup, J. Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

Experimental relations between mass, charge and energy loss of fragments from damped reactions are analyzed in terms of an independent-particle transport model. A quantitative description of data is achieved including the energy loss-dependence of isobaric and isotopic fragment distributions.

32684 (DOE/ER/03496—T1, pp 19-45) **Dissipative reaction dynamics of heavy-ion collisions.** Schroeder, W.U.; Huizenga, J.R. (Univ. of Rochester, NY). Jul 1981. NTIS, PC A12/MF A01.

In Studies of heavy-ion reactions and transuranic nuclei. Progress report, August 1, 1980-July 31, 1981.

Experimental studies of damped nuclear reactions have yielded evidence for a formation of a transient dinuclear system that dynamically evolves in time while microscopic processes lead to a gradually increasing complexity of the reaction bridging the gap from quasi-elastic to fusion collisions. There are strong indications for the dominance of the stochastic exchange of independent nucleons in damped reactions leading to the dissipative and fluctuative phenomena observed. There may also be other mechanisms proceeding concurrently, but it remains an experimental and theoretical task to establish the conditions under which such alternative mechanisms may be positively identified.

32685 (LA—8835C, pp 177-192) **Intranuclear cascade theory as a quantum mechanical approximation.** Remler, E.A. (Coll. of William and Mary, Williamsburg, VA). May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

Nuclear theorists have usually maintained an indifferent attitude towards intranuclear cascade theory (INC). Since it was classical it was said to be of no interest to a quantum mechanician. As a result it has had virtually no theoretical development since its inception. INC as well as other closely related quasi-classical theories do give a reasonable account of the gross features of a large variety of complex nuclear reactions. Therefore there must be a series of approximations leading from the full QM theory to INC. By retracing these, one should be able to develop INC (much the same as WKB) into a systematic QM approximation procedure. This talk discusses some progress which has been made towards this end. In particular, the following questions are discussed; (1) what QM object does INC provide an approximation of, (2) what is the relation between INC and other quasi-classical theories, (3) how can its accuracy be increased, (4) what is its scope and how can that be increased.

32686 (LA—8835C, pp 344-362) **NC-5 new theoretical approaches. Summary report and recommendations from panel.** Sternheim, M.M. (Univ. of Massachusetts, Amherst); Liu, L.C. May 1981. NTIS, PC A18/MF A01.

From Intermediate-energy nuclear chemistry workshop; Los Alamos, NM, USA (23 Jun 1980).

The theory panel met only for one morning, rather than for the longer time allocated for most of the panels. This presumably reflected the idea that theory in this field is usually most productive when it is related to specific experiments. The panel accordingly dealt mainly with questions of a more general and fundamental character such as the applicability of specific theoretical methods and possible improvements to practical calculational schemes. The six talks presented to the panel were of two complementary types, reflecting the status of the field. Some talks aimed at exploring and extending the fundamental applicability of the intranuclear cascade and related methods. Other talks explored simpler, alternative descriptions of the complex hadron-nucleus interactions, or examined the validity of the currently used dynamical assumptions. The panel also discussed ways of improving the existing calculational methods.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 32625

32687 (CONF-810920—12) Use of oxide targets in 2-keV average neutron capture measurements. Tang, J.S.; Raman, S. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029673.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

Large samples ($\approx$ 10 to 100 grams) are usually required for 2-keV filtered-beam measurements and such samples invariably come in the oxide form. Monte Carlo calculations show that the resulting neutron spectrum is degraded by $\approx$ 0.2 keV in a $^{148}Nd_2O_3$ sample. Otherwise, oxide samples are acceptable for such measurements.

32688 (CONF-810920—13) Selected topics in thermal and resonance neutron capture. Raman, S. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE81029676.

From 4. international symposium on neutron-capture gamma-ray spectroscopy and related topics; Grenoble, France (7 Sep 1981).

Several topics of current interest are discussed including energy and intensity standards, direct thermal neutron capture, primary E2 transitions in (n,γ) reactions, nonstatistical effects in resonance neutron capture, transmission measurements of Sc employed in 2-keV facilities, and tests of Axel-Brink predictions of γ-ray strength functions via average resonance capture.

32689 (UCLA-ENG—7399) Particle range and energy deposition in materials containing voids. Odette, G.R.; Schwartz, D.M.; Ardell, A.J. (California Univ., Los Angeles (USA). School of Engineering and Applied Science; California Univ., Santa Barbara (USA). Dept. of Chemical and Nuclear Engineering; California State Univ., Northridge (USA). School of Engineering). Dec 1973. Contract AT03-76ER70172. 22p. (UCLA—34P172-10). NTIS, PC A02/MF A01. Order Number DE81024200.

The manner in which voids affect both the range and the energy deposition of energetic charged particles in irradiated metals has been investigated. Calculations of energy deposition for 5 MeV Cu^{++} ions and 1 MeV protons incident on Fe indicate uncertainties in these quantities that increase with penetration distance. Mass density corrections adequately account for the presence of voids, except at the end of range where the contribution of void-induced straggling can be significant. The extension of the average range in these samples can be appreciable, depending upon the relationship between swelling and dose.

6550 Medical Physics

32690 (CONF-810850—1) Performance of neutron and gamma personnel dosimetry in mixed radiation fields. Swaja, R.E.; Sims, C.S. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE81028140.

From Annual meeting of the Australian Radiation Protection Society; Sydney, Australia (24 Aug 1981).

From 1974 to 1980, six personnel dosimetry intercomparison studies (PDIS) were conducted at the Oak Ridge National Laboratory (ORNL) to evaluate the performance of personnel dosimeters in a variety of neutron and gamma fields produced by operating the Health Physics Research Reactor (HPRR) in the steady state mode with and without spectral modifying shields. A total of 58 different organizations participated in these studies which produced approximately 2000 measurements of neutron and gamma dose equivalents on anthropomorphic phantoms for five different reactor spectra. Based on these data, the relative performance of three basic types of neutron dosimeters [nuclear emulsion film, thermoluminescent (TLD), and track-etch] and two basic types of gamma dosimeters (film and TLD) in mixed radiation fields was assessed.

32691 (DOE/EV/01671—T1) Theory of RBE. Fifth triennial report, 1 January 1967-31 December 1981. Katz, R. (Nebraska Univ., Lincoln (USA). Dept. of Physics). Jul 1981. Contract AS02-76EV01671. 40p. (COO—1671-87; COO—1671-88). NTIS, PC A03/MF A01. Order Number DE81029634.

A single theme, that the response of a detector to gamma-rays (interpreted probabilistically through an extension of target theory) can be mapped into the region surrounding the path of an energetic heavy ion, through the local dose deposited by its delta-rays, has been the continuing basis of the present research. In order to systematize the understanding of RBE we have introduced new concepts to create a predictive theory of radiation response, of the structure of particle tracks, in a wide range of physical and biological systems. We have built a theory that is more generally applicable, to physical as well as to biological detectors, using the same basic concepts and operationally defined parameters. This procedure enables us to make quantitative experimental tests of the validity of our conceptual structure. We have created a systematic classification of detector properties, and have shown how their response varies with the numerical values of detector parameters within these classifications. Especially for 1-hit detection, our theory is universally accepted and applied. Originally created to explain the RBE of dry enzymes and viruses, it has been extended to scintillation counters, to particle tracks in nuclear emulsions, to thermoluminescent dosimeters, to lyo-luminescence, to single strand breaks in DNA, to the formation of color centers in crystals, and onwards. The extension of this conceptual system to biology required the many-hit detector, with its potential for the accumulation of sub-lethal damage. We have predicted the response of biological cells in high LET environments from this theory. It has served as the stimulus for discovering many hit physical systems (emulsions, photoresists) which respond preferentially to high LET radiations.

32692 (PNL-SA—9088) Active neutron instrumentation. Endres, G.W.R.; Brackenbush, L.W.; Faust, L.G. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 12p. (CONF-810103—3). NTIS, PC A02/MF A01.

From Measurement science conference; Anaheim, CA, USA (30 Jan 1981).

An introduction to neutron interactions in tissue and a discussion of pertinent nuetron cross-sections will be given. A brief description of the statistics of energy deposition due to interactions of neutron secondaries in tissue equivalent media is presented. Present and past techniques for measurement of neutron radiation fields are given with advantages and disadvantages in the light of legal limits and proposed changes in those requirements. Neutron dose measuring devices, such as the tissue equivalent proportional counter (TEPC) developed by Rossi, are discussed with emphasis on their response in varying neutron energy spectra. Techniques for determining neutron quality factors from TEPC response functions are discussed along with implications of possible new definitions of quality factor. A brief description of high-resolution spectrometry systems, which use hydrogen, methane and He-3 fill gases, is given with discussion of their limitations. Low resolution systems, such as multisphere spectrometers and activation foils, are also presented.

6560 Solid State Physics

32693 (DOE/ER/01198—1361) Illustrative numerical comparisons between phonon mean free paths and phonon thermal conductivity. MacDonald, W.M.; Anderson, A.C. (Illinois Univ., Urbana (USA). Materials Research Lab.). 1981. Contract AC02-76ER01198. 9p. (CONF-810683—5). NTIS, PC A02/MF A01. Order Number DE81028180.

From International joint conference on thermophysical properties; Gaithersburg, MD, USA (15 Jun 1981).

Measurements of thermal conductivity are often used as an interrogative technique to learn about phonon scattering processes in solids. In general the relationship between thermal conductivity λ and a phonon mean free path l is complex and it is therefore necessary to make some simplifying assumptions in order to make this relationship tractable. These assumptions may lead to erroneous conclusions, many of which have appeared in the published litera-

ture. An intuitive insight is provided to the relationship between λ and l.

6561 Superconductivity

REFER ALSO TO CITATION(S) 32271, 32275

32694 **(CONF-810809—16) Statistical-summation theory of weak flux-line pins.** Kerchner, H.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 2p. NTIS, PC A02/MF A01. Order Number DE81029143.

From 16. international conference on low temperature physics; Los Angeles, CA, USA (19 Aug 1981).

A random array of flux-line-pinning defects is shown to produce a large, bulk pinning-force density even if the pins individually fail to satisfy the threshold criterion. By using a simplified model defect-FLL interaction, approximate expressions are obtained for the critical pinning-force density F/sub c/. The theory predicts that in materials with a weak pinning structure F/sub c/ depends only weakly on magnetic field except within narrow peaks near the upper and lower critical fields. The width of the peaks increases as the pinning is made stronger. A broad, dome-shaped peak in F/sub c/ and scaling-law behavior, both of which are usually associated with large F/sub c/ materials, is the strong-pinning limit of this theory.

32695 **Effects of intermetallic boundaries in inhomogeneous superconductors.** Ovadyahu, Z.; Entin-Wohlman, O. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Physics F: Metal Physics ;* **10**: No. 7, 1525-1537(Jul 1980).

An empirical self-consistent method for studying the tunnelling density of states of normal-metal-superconductor double layers is described. The role of the intermetallic boundary in controlling spatial variation of the order parameter in inhomogeneous media is elucidated. It is suggested that under certain conditions, tunnelling data taken from such systems may be used to extract quantitative information.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 32653, 32699

32696 **(DOE/ER/03992—440) Progress in supergravity.** Ne'eman, Y. (Texas Univ., Austin (USA); Tel Aviv Univ. (Israel)). Apr 1981. Contract AS05-76ER03992. 31p. (CONF-801250—2). NTIS, PC A03/MF A01. Order Number DE81028695.

From 10. Texas symposium on relativistic astrophysics; Baltimore, MD, USA (15 Dec 1980).

The theory of supergravity is reviewed with emphasis on the key achievements: 2-loop finiteness of quantum gravity, including the presence of matter, provided that this matter together with the gravitational field forms appropriate extended gauge supermultiplet; 3-loop super-renormalizability of a sample theory (N = 4 Super-Yang Mills), resembling N = 8 extended supergravity; vanishing of geometrical counter-terms for n loops, n < N; positive definiteness of the gravitational Hamiltonian; and the removal of the Johnson-Sudarshan and other inconsistencies, which used to plague spin 3/2 theories. (GHT)

32697 **(LA—8875) Diffusivity of particles moving rapidly through a turbulent fluid.** Margolin, L.G. (Los Alamos National Lab., NM (USA)). Aug 1981. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01. Order Number DE81030414.

Theoretical studies of the diffusion of small particles in a turbulent fluid predict that particles will diffuse like passive scalars. Experimental measurements of the diffusion of smail beads in turbulent air yield particle diffusivities much smaller than passive scalar diffusivity. In this report, the theoretical assumptions are contrasted with the experimental conditions. One assumption, usually called the neighborhood hypothesis, is not justifiable when the particles have a large mean velocity relative to the fluid. Therefore, a new model, valid in these circumstances, that is in good agreement with the experiment is constructed.

32698 **(ORNL/CSD—81) Stefan problem with a convective boundary condition.** Solomon, A.D.; Alexiades, V.; Wilson, D.G. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01. Order Number DE81030424.

We study the one-phase Stefan problem on a semi-infinite strip x ≧ 0, with the convective boundary condition - KT/sub x/(0,t) = h[T/sub L/-T(0,t)]. Points of interest include: (a) behavior of the surface temperature T(0,t); (b) asymptotic behavior as h → ∞; (c) uniqueness, and (d) bounds on the phase change front and total system energy.

6580 Mathematical Physics

32699 **(DOE/ER/03992—443) Relativistic particle interactions: a Third World view.** Balachandran, A.P.; Marmo, G.; Mukunda, N.; Nilsson, J.S.; Simoni, A.; Sudarshan, E.C.G.; Zaccaria, F. (Istituto Nazionale di Fisica Nucleare, Naples (Italy)). May 1981. Contract AS05-76ER03992. 39p. NTIS, PC A03/MF A01. Order Number DE81028346.

A new form for describing interacting relativistic classical particles with invariant world lines is presented. In contrast to the use of independent particle variables or of centre of mass and relative coordinates previously considered in the literature, a Lorentz matrix is introduced and an associated conjugate four-dimensional angular momentum as collective variables; these are supplemented with a suitable number of internal variables. The methods of constrained Hamiltonian dynamics are used to ensure that the number of independent degrees of freedom corresponds precisely to that for a system of a given number of particles. Independent particle variables can be defined in the formalism, and interactions included. The eleven generator form for relativistic Hamiltonian dyanmics is essential to make relativistic invariance, invariant world lines, and interaction, compatible with one another.

32700 **(UCRL—85278) Axisymmetric finite deformation membrane problems.** Feng, W.W. (Lawrence Livermore National Lab., CA (USA)). 12 Dec 1980. Contract W-7405-ENG-48. 4p. (CONF-810621—6). NTIS, PC A02/MF A01. Order Number DE81030070.

From Symposium on fluid mechanics of combustion systems; Boulder, CO, USA (22 Jun 1981).

Many biomechanic problems involve the analysis of finite deformation axisymmetric membranes. This paper presents the general formulation for solving a class of axisymmetric membrane problems. The material nonlinearity, as well as the geometric nonlinearity, is considered. Two methods are presented to solve these problems. The first method is solving a set of differential equilibrium equations. The governing equations are reduced to three first-order ordinary-differential equations with explicit derivatives. The second method is the Ritz method where a general potential energy functional valid for all axisymmetric deformed positions is presented. The geometric admissible functions that govern the deformed configuration are written in terms of a series with unknown coefficients. These unknown coefficients are determined by the minimum potential energy principle that of all geometric admissible deformed configurations, the equilibrium configuration minimizes the potential energy. Some examples are presented. A comparison between these two methods is mentioned.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 32766, 32769

32701 **(AD-A—089180) Effect of finite electron drift velocity on the resonant excitation of a nonuniform plasma.** Morales, G.J.; Lamb, B.M.; Adler, E.A. (California Univ., Los Angeles (USA). Plasma Physics Group). Jul 1980. Contract N00014-75-C-0476. 32p. NTIS, PC A03/MF A01.

An exact analytic solution of the external resonant excitation of a nonuniform plasma in the presence of a zero order finite electron drift is presented. The process of linear mode conversion of

the long wavelength external radiation, of frequency omega, into a Langmuir wave limits the peak amplitude of the cold plasma resonance at omega = omega sub p, where omega sub p is the local electron plasma frequency. The finite electron drift alters the effective group velocity of the Langmuir wave, and thus it modifies the peak amplitude of the resonance in a significant manner. For drifts toward the overdense side an amplitude enhancement is obtained, while for drifts toward the underdense side a severe quenching takes place. The effect is governed by a single scaled drift parameter, and significant modifications arise when its absolute value is greater than 1.

32702 **(AD-A—089372) Computer simulation studies of the tearing mode instability in a field-reversed ion layer. Memorandum report.** Marsh, S.J.; Drobot, A.T.; Kapetanakos, C.A. (Naval Research Lab., Washington, DC (USA)). 15 Sep 1980. 37p. NTIS, PC A03/MF A01.

Results are reported on the computer simulation of a long, space charge neutral ion layer. The critical axial velocity spread required to stabilize the tearing mode is in agreement with the predictions of Uhm and Davidson. The growth rates of individual modes depend on the evolving profile of the distribution functions. For initially square velocity distribution profile, the code predicts growth rates that are slower by about a factor of two than those of the linear theory. In addition, it has been demonstrated that when the Budker parameter of the layer nu exceeds 1/3, a conducting wall surrounding the layer may have a destabilizing influence on it.

32703 **(CONF-800932—9) Lower hybrid rf heating experiments in the MIT Alcator A, C and Versator II tokamaks.** Porkolab, M.; Schuss, J.; Takase, Y.; Chen, K.I.; Knowlton, S.; Luckhardt, S.; McDermott, S. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 1980. Contract AS02-78ET53076. 12p. NTIS, PC A02/MF A01. Order Number DE81028193.

From 2. joint Grenoble-Varenna international symposium on heating in toroidal plasmas; Como, Italy (3 Sep 1980).

Experimental results on lower hybrid heating in the Alcator A and the Versator II tokamaks with power levels up to 90 kW are presented. In Alcator A a double waveguide grill, and in Versator II a 4 waveguide grill with arbitrary phasing are used. Also, a 6 waveguide grill experiment in Versator II is described which launches a travelling wave aimed at driving toroidal currents. The forthcoming lower hybrid heating experiment in Alcator C, utilizing four 4 x 4 waveguide arrays with power levels up to 4 MW, is also described.

32704 **(DOE/ER/53110—T1) Progress report for Contract Number DE-AC02-81ER53110.** (Dartmouth Coll., Hanover, NH (USA)). 1981. Contract AC02-81ER53110. 3p. NTIS, PC A02/MF A01. Order Number DE81027967.

The project originally proposed under this contract consisted of two parts: (1) Calculation of the electron synchrotron radiation spectrum emitted by a volume element of plasma with arbitrary distribution functions. Investigation of the dependence of the spectrum on the form and parameters of the distribution function. (2) Computation of the synchrotron power loss from the EBT ring plasma using the computer code developed in Part 1 with a model of EBT ring plasma parameters and geometry. A summary of work done on Part 1 is given.

32705 **(DOE/ET/51013—7) Nonlinear coupling and propagation of lower hybrid waves.** Theilhaber, K.S.; Bers, A. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Feb 1981. Contract AC02-78ET51013. 9p. (PFC/RR—81-5; CONF-810214—7). NTIS, PC A02/MF A01. Order Number DE81029876.

From 4. topical conference on radio frequency plasma heating; Austin, TX, USA (9 Feb 1981).

The nonlinear coupling and propagation of lower hybrid waves excited by a waveguide array are examined numerically in a model of an inhomogeneous Tokamak plasma. The nonlinearity is the ponderomotive force which results in self-modulation of the lower hybrid waves. We evolve self-consistently the fields in time to a steady-state. Both travelling and standing wave excitations are considered. The dependence of reflectivity on the nonlinearity is studied and found to exhibit qualitative behavior seen in experiments. The nonlinearity also produces density holes in front of the waveguides, and the accompanying fields are strongly focused. In Fourier space, the parallel wave spectrum is broadened and upshifted. In the travelling wave case the spectrum is broadened but remains unindirectional, that is negative k/sub z/ are not generated.

32706 **(DOE/ET/51013—8) RF-driven tokamak reactor with sub-ignited, thermally stable operation.** Harten, L.P.; Bers, A.; Fuchs, V.; Shoucri, M.M. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Feb 1981. Contract AC02-78ET51013. 9p. (PFC/RR—81-6). NTIS, PC A02/MF A01. Order Number DE81029437.

A Radio-Frequency Driven Tokamak Reactor (RFDTR) can use RF-power, programmed by a delayed temperature measurement, to thermally stabilize a power equilibrium below ignition, and to drive a steady state current. We propose the parameters for such a device generating $\simeq$ 1600 MW thermal power and operating with $Q \simeq 40$ (= power out/power in). A one temperature zero-dimensional model allows simple analytical formulation of the problem. The relevance of injected impurities for locating the equilibrium is discussed. We present the results of a one-dimensional (radial) code which includes the deposition of the supplementary power, and compare with our zero-dimensional model.

32707 **(DOE/ET/51013—9) Antenna-plasma coupling theory for ICRF heating of large tokamaks.** Bers, A.; Harten, L.P.; Ram, A. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Feb 1981. Contract AC02-78ET51013. 7p. NTIS, PC A02/MF A01. Order Number DE81029815.

The radiation impedance of, and field excitation by, current sheets external to a large (minor radius) plasma are calculated. The finite-size antenna current modeled by these current sheets is screened from the plasma by a sheath of anisotropic conductivity which shorts out locally the toroidal rf electric field but does not affect the poloidal rf electric field. The plasma near the antenna is modeled by its cold dielectric tensor having an inhomogeneous density and applied magnetic field. The field analysis for the coupling and power flow is carried out in a slab geometry.

32708 **(DOE/ET/51013—10) LH wave absorption by mode conversion near ion cyclotron harmonics.** Ko, K.; Bers, A.; Fuchs, V. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Feb 1981. Contract AC02-78ET51013. 8p. (CONF-810214—8). NTIS, PC A02/MF A01. Order Number DE81029434.

From 4. topical conference on radio frequency plasma heating; Austin, TX, USA (9 Feb 1981).

Numerical studies of the dispersion relation near the lower-hybrid frequency in an inhomogeneous plasma (Δ n, Δ T, Δ B) show that portions of an incident lower-hybrid wave spectrum undergo successive but partial mode conversions to warm-plasma waves in the presence of ion cyclotron harmonics. Wave absorption beyond the first mode conversion occurs near an ion cyclotron harmonic where ion Landau damping is enhanced. A second-order dispersion relation numerically in good agreement with the full dispersion relation in the mode conversion region is derived using the condition $\partial D/\partial k = 0$. The mode conversion efficiency at each confluence is evaluated by solving the corresponding differential equation.

32709 **(DOE/ET/51013—11) Nonlinear steady-state coupling of LH waves.** Ko, K.; Krapchev, V.B. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Feb 1981. Contract AC02-78ET51013. 8p. (PFC/RR—81-9; CONF-810214—9). NTIS, PC A02/MF A01. Order Number DE81029435.

From 4. topical conference on radio frequency plasma heating; Austin, TX, USA (9 Feb 1981).

The coupling of lower hybrid waves at the plasma edge by a two waveguide array with self-consistent density modulation is solved numerically. For a linear density profile, the governing nonlinear Klein-Gordon equation for the electric field can be written as a system of nonlinearly modified Airy equations in Fourier k/sub z/-space. Numerical solutions to the nonlinear system satisfying ra-

diation condition are obtained. Spectra broadening and modifications to resonance cone trajectories are observed with increase of incident power.

32710 (DOE/ET/53032—43) Annual progress report. Simon, A. (Rochester Univ., NY (USA). Dept. of Mechanical Engineering). 31 Jul 1981. Contract AS02-76ET53032. 49p. NTIS, PC A03/MF A01. Order Number DE81027951.

A single-mode, nonlinear analysis of the 2XIIB experimental results is under development. A Model-I (infinite geometry, no mirror losses or source beams) analysis is nearly complete. Model II (mirror losses, beams, energy drag) is in progress. Nonlinear analysis of the 2ω/sub p/ instability near the quarter-critical point in an inhomogeneous plasma is continuing.

32711 (DOE/ET/53036—27) Characteristics of low frequency MHD fluctuations in the PRETEXT tokamak. Kochanski, T.P. (Texas Univ., Austin (USA). Fusion Research Center). May 1981. Contract AC05-76ET53036. 191p. NTIS, PC A09/MF A01. Order Number DE81029720.

Thesis.

The temporal and spectral characteristics of low frequency (< 100KHz) MHD fluctuations, which are commonly associated with disruptions, have been investigated in the PRETEXT tokamak. There exists rigid phase coherence between the internal m = 1, and externally detected m = 2 modes indicative of strong mode coupling. A parametric study of the frequency of the mode, in the saturated state, indicates that the frequency scales with the toroidal magnetic field, and is inversely proportional to the plasma current. The frequency is observed to decrease abruptly as the mode amplitude rapidly increases prior to a plasma disruption. The burst type growth of the m = 2 mode appears to be inextricably linked to the occurrence of the disruptive instability.

32712 (DOE/ET/53036—28) Ion thermal conductivity for a pure tokamak plasma. Bolton, C.W. III. (Texas Univ., Austin (USA). Fusion Research Center). Jun 1981. Contract AC05-76ET53036. 117p. NTIS, PC A06/MF A01. Order Number DE81029710.

Thesis.

The ion thermal conductivity is calculated for a wide range of aspect ratios and collision frequencies. The calculation is done by solving the drift kinetic equation, with a model collision operator, using a finite element method, and then calculating the energy weighted friction force to determine the heat flux. The thermal conductivity, determined from the heat flux, is then curve fitted to analytic formulas. These formulas allow the conductivity to be calculated at all collision frequencies and aspect ratios down to about 3.

32713 (DOE/ET/53036—30) Theoretical aspects of the nonlinear interaction of drift-type instabilities in a plasma. Terry, P. (Texas Univ., Austin (USA). Fusion Research Center). Jul 1981. Contract AC05-76ET53036. 177p. NTIS, PC A09/MF A01. Order Number DE81028507.

Thesis.

Various theoretical aspects of plasma turbulence are explored in the context of low frequency drift-type instabilities in toroidally confined plasmas. Of central importance is consideration of the random phase approximation - its role and validity in plasma turbulence theories. Linear theory is first considered to find the criteria for marginal stability of the toroidal ion temperature gradient drift mode. Analytic criteria for the onset of instability giving the dependence on wavenumber, magnetic curvature, and temperature gradient are derived from the drift kinetic equation with the grad-B and curvature drift resonances retained.

32714 (DOE/ET/53042—2) Breakdown in the pretext tokamak. Benesch, J.F. (Texas Univ., Austin (USA)). Jun 1981. Contract AS05-77ET53042. 83p. NTIS, PC A05/MF A01. Order Number DE81029362.

Data are presented on the application of ion cyclotron resonance RF power to preionization in tokamaks. We applied 0.3-3 kW at 12 MHz to hydrogen and obtained a visible discharge, but found no scaling of breakdown voltage with any parameter we were able to vary. A possible explanation for this, which implies that higher RF power would have been much more effective, is discussed. Finally, we present our investigation of the dV/dt dependence of breakdown voltage in PRETEXT, a phenomenon also seen in JFT-2. The breakdown is discussed in terms of the physics of Townsend discharges.

32715 (DOE/ET/53042—24) Investigation of runaway electrons in the PRETEXT Tokamak. Eckstrand, S.A. (Texas Univ., Austin (USA). Fusion Research Center). Jan 1981. Contract AS05-77ET53042. 120p. NTIS, PC A06/MF A01. Order Number DE81029984.

Thesis.

High energy (0.2 to 0.4 MeV) runaway electrons have been studied in PRETEXT discharges by detecting the hard x-ray bremsstrahlung radiation produced when they escape from the discharge and strike the limiter. A pulse height analysis system, which included pileup rejection circuitry because of the high count rate, recorded both the amplitude and arrival time of each pulse.

32716 (DOE/ET/53045—T1) Nonlinear magnetohydrodynamics. Progress report, January 1, 1981-December 31, 1981. Vahala, G.; Montgomery, D. (College of William and Mary, Williamsburg, VA (USA)). 1981. Contract AS05-76ET53045. 26p. (ORO—5260-5). NTIS, PC A03/MF A01. Order Number DE81027014.

The major effort was directed to the statistical determination of the most probable equilibrium profiles given global information on the toroidal flux phi, toroidal current I, magnetic field at the wall B/sub z/(1), magnetic energy E, magnetic helicity H. It should be noted that the experimentalist has phi, I, B/sub z/(1) under his control during the evolution of a tokamak or RFP discharge. The poster paper presented at the 1981 Sherwood meeting is included.

32717 (DOE/ET/53051—24) Equilibrium and stability of experimental high β toroidal plasmas. Prager, S.C. (Wisconsin Univ., Madison (USA)). 1981. Contract AS02-76ET53051. 12p. (CONF-811028—(Absts.)). NTIS, PC A02/MF A01. Order Number DE81023610.

From 23. annual meeting of the division of plasma physics of the APS; New York, NY, USA (12 Oct 1981).

32718 (DOE/ET/53083—3) Investigation of auxiliary heating in tandem mirrors and tokamaks and barrier cell pumping. Annual progress report, October 1, 1980 to December 31, 1981. Emmert, G.A.; Scharer, J. (Wisconsin Univ., Madison (USA)). Jun 1981. Contract AC02-79ET53083. 24p. NTIS, PC A02/MF A01. Order Number DE81026777.

The research has focussed on physics questions concerned with ECRH heating in tandem mirror plugs, pumping of tandem mirror thermal barriers by drift orbits, ICRH heating in tokamaks, and bundle divertors. We have concluded that drift-orbit pumping of thermal barriers is not feasible because the azimuthal E Vector X B Vector drift limits the excursion of trapped ions from a flux surface. We have developed a three-dimensional weakly relativistic (T/sub e/ ≦ 50 keV) ray tracing and absorption code for electron cyclotron heating in tandem mirror plugs and barriers. Cases run for TMX, MFTF-B and reactors at T/sub e/ > 10 keV show that strong absorption per pass is present and a careful choice of wave frequency and launch angle is required to ensure wave penetration and absorption in the plasma core. In the area of ion cyclotron frequency range heating in tokamaks, a three-dimensional hot plasma ray tracing theory and code has been developed to handle rays launched from any poloidal angle in the tokamak cross section. Wave heating in the central strong absorption zones is currently being investigated using a full wave solution for the various heating regimes.

32719 (DOE/ET/53088—30) Turbulent response in a stochastic regime. Molvig, K.; Freidberg, J.P.; Potok, R.; Hirshman, S.P.; Whitson, J.C.; Tajima, T. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jun 1981. Contract FG05-80ET53088. 28p. NTIS, PC A03/MF A01. Order Number DE81029768.

The theory for the non-linear, turbulent response in a system with intrinsic stochasticity is considered. It is argued that perturba-

tive Eulerian theories, such as the Direct Interaction Approximation (DIA), are inherently unsuited to describe such a system. The exponentiation property that characterizes stochasticity appears in the Lagrangian picture and cannot even be defined in the Eulerian representation. An approximation for stochastic systems - the Normal Stochastic Approximation - is developed and states that the perturbed orbit functions (Lagrangian fluctuations) behave as normally distributed random variables. This is independent of the Eulerian statistics and, in fact, we treat the Eulerian fluctuations as fixed. A simple model problem (appropriate for the electron response in the drift wave) is subjected to a series of computer experiments. To within numerical noise the results are in agreement with the Normal Stochastic Approximation. The predictions of the DIA for this mode show substantial qualitative and quantitative departures from the observations.

32720 **(DOE/ET/53104—1) Annual progress report on magnetic confinement fusion plasma theory, July 14, 1980-December 31, 1981.** Callen, J.D. (Wisconsin Univ., Madison (USA)). Jul 1981. Contract AC02-80ER53104. 17p. NTIS, PC A02/MF A01. Order Number DE81029789.

The research has concentrated on some key magnetic mirror confinement physics questions (gyrophase diffusion, alpha particle losses, and coil misalignmet effects) and on a fairly comprehensive development of neoclassical transport in rippled tokamaks and stellarators including effects due to a boundary layer, energy smoothing, an electric field, direct particle loss and helical trapping. There also have been some minor projects on tandem mirror boundary layers, kinetic effects on rippling modes in the edge of a tokamak, and ballooning modes in tandem mirrors, the large Octupole, and stellarators.

32721 **Tearing-mode stability of tokamak plasmas with elliptical cross-section.** Carreras, B.A.; Holmes, J.A.; Hicks, H.R.; Lynch, V.E. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion ;* **21**: No. 5, 511-517(May 1981).

The effect of the ellipticity of the plasma cross-section on tearing-mode stability is investigated. The induced coupling between modes is shown to be de-stabilizing. The modification of the equilibrium tends, however, to stabilize the tearing modes. The net effect depends on the manner in which the equilibrium is modified as the plasma cross-section shape is changed.

32722 **(PB—81-850943) Magnetic field configuration and plasma stability/instability. January, 1970-September, 1980 (citations from the NTIS Data Base). Report for Jan 70-Sep 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 95p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning both theoretical and experimental magnetic field configuration effects upon plasma stability/instability in controlled or confined plasmas. Various types of plasma containment devices (e.g., TOKAMAKS, TOKAPOLES, etc.) are discussed, along with specific types of instabilities which may occur in confined plasmas. (Contains 92 citations.)

32723 **(PB—81-850950) Magnetic field configuration and plasma stability/instability. January, 1976-September, 1980 (citations from the Energy Data Base). Report for Jan 76-Sep 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 264p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning both theoretical and experimental magnetic field configuration effects upon plasma stability/instability in controlled or confined plasmas. Various types of plasma containment devices (e.g., TOKAMAKS, TOKAPOLES, etc.) are discussed, along with specific types of instabilities which may occur in confined plasmas. (Contains 294 citations.)

32724 **(PB—81-850968) Magnetic field configuration and plasma stability/instability. January, 1972-September, 1980 (citations from the International Aerospace Abstracts Data Base). Report for Jan 72-Sep 80.** Frey, J.H. (New England Research Application Center, Storrs, CT (USA)). Oct 1980. 258p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning both theoretical and experimental magnetic field configuration effects upon plasma stability/instability in controlled or confined plasmas. Various types of plasma containment devices (e.g., TOKAMAKS, TOKAPOLES, etc.) are discussed, along with specific types of instabilities which may occur in confined plasmas. (Contains 300 citations.)

32725 **(PPPL—1821) Statistical description of an attractor.** Rechester, A.B.; White, R.B. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jul 1981. Contract AC02-76CH03073. 14p. NTIS, PC A02/MF A01. Order Number DE81027708.

Attracting solutions of one dimensional maps are described statistically by an invariant probability distribution. Expressions for the Fourier transform of this function and the Liapunov exponent are derived. Good agreement between the theory and numerical computations is found.

32726 **(UCID—19160) TMX-upgrade. X-ray diagnostic: low-energy temperature determination.** Jacoby, B.A. (Lawrence Livermore National Lab., CA (USA)). May 1981. Contract W-7405-ENG-48. 57p. NTIS, PC A04/MF A01. Order Number DE81029109.

In order to properly design the x-ray filter set, a reasonable computational model of the plasma emission had to be developed. The radiation continuum computed consisted of two components: bremsstrahlung and recombination radiation. The contribution of line radiation from low Z impurities was estimated to be negligible for x-ray energies above 1 keV.

32727 **(UCRL—86498) Fusion Forum 1981.** Fowler, T.K. (Lawrence Livermore National Lab., CA (USA)). 28 Jul 1981. Contract W-7405-ENG-48. 29p. (CONF-8106142—1). NTIS, PC A03/MF A01. Order Number DE81028850.

From Fusion forum; Auburn, AL, USA (19 Jun 1981).

This review covers the basics of the fusion process. Some research programs and their present status are mentioned. (MOW)

32728 **Numerical study of high-beta stellarator equilibria.** Barnes, D.C. (Los Alamos Scientific Lab., NM (USA)); Brackbill, J.U. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences); Schneider, W.O. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). *Nuclear Fusion ;* **21**: No. 5, 537-552(May 1981).

A numerical study of surface- and diffuse-current, high-beta stellarator equilibria is described. Numerical results are obtained from an algorithm for the solution of the ideal magnetohydrodynamic equations in three dimensions as an initial- and boundary-value problem. Equilibria are obtained for diffuse-current plasmas just as for surface-current plasmas. The equilibrium conditions for diffuse-current plasmas are quantitatively different from those for surface-current plasmas, especially at high beta for l=0,1 systems. In contrast, the equilibrium conditions scale according to small-delta theory even to delta approximately 1. Results are obtained for a range of dimensionless parameters (beta, aspect ratio, etc.) and compared to an asymptotic equilibrium theory and experiments. Good agreement among the two theories and the experiments is shown.

32729 **Generalized sufficient condition for velocity-space stability of fusion product distributions and application to heating of D-T tokamak reactors.** Cordey, J.G. (Euratom/UKAEA Fusion Association, Abingdon (UK). Culham Lab.); Goldston, R.J.; Mikkelsen, D.R. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion ;* **21**: No. 5, 581-588(May 1981).

A generalized condition is derived for the velocity-space distribution of suprathermal alpha-particles to be monotonically decreasing with energy - and hence stable to homogeneous plasma instabilities - during the heating phase of a tokamak reactor. This stability condition is easily satisfied for presently envisaged neutral-injection heating of reactors, but may be violated in strong heating of smaller plasmas or during fast compressional heating.

32730 Analytic model for classical ion confinement in tandem mirror plugs. Logan, B.G.; Mirin, A.A.; Rensink, M.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Nuclear Fusion ;* **20**: No. 12, 1613-1616(Dec 1980).

Letter-to-the-editor.

A heuristic model for classical ion confinement in a magnetic mirror is presented. The competing influences of electron drag and ion-ion scattering motivated us to develop this model. Its predictions are compared with computational results from a Fokker-Planck code. For a range of plasma parameters typical of tandem mirror reactor plugs, the model is accurate to within +-10%.

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REFER ALSO TO CITATION(S) 32109, 32226, 32228, 32230, 32231, 32236, 32237, 32240, 32248, 32256, 32257, 32270, 32331, 32343, 32344, 32346, 32627, 32661

32731 (AD-A—092588) Linear stability of self-similar flow. 8. Imploding cylindrical and spherical shocks in the C-C-W approximation. Memorandum report. Gardner, J.H.; Book, D.L.; Bernstein, I.B. (Naval Research Lab., Washington, DC (USA)). 31 Oct 1980. 39p. NTIS, PC A03/MF A01.

Analytical and computational techniques are developed to investigate the stability of converging shock waves in cylindrical and spherical geometry. The linearized Chester-Chisnell-Whitham (C-C-W) equations describing the evolution of an arbitrary perturbation about an imploding shock wave in an ideal fluid are solved exactly in the strong-shock limit for a density profile rho(r) approx (r to the -q power). All modes are found to be relatively unstable (i.e., the ratio of perturbation amplitude to shock radius diverges as the latter goes to zero), provided that q is not too large. The nonlinear C-C-W equations are solved numerically for both moderate and strong shocks. The small-amplitude limit agrees with the analytical results, but some forms of perturbation which are stable at small amplitude become unstable in the nonlinear regime. The results are related to the problem of pellet compression in experiments on inertial confinement fusion.

32732 (CONF-810745—1) Pumped limiter development on ISX. Mioduszewski, P.K.; Edmonds, P.H.; Sheffield, J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE81026356.

From IAEA technical committee meeting on divertors and impurity control in tokamaks; Garching, F.R. Germany (6 Jul 1981).

Pumped limiter configurations are being suggested for FED and INTOR for helium ash exhaust and fuel particle control. The goal of the pump limiter studies in ISX is the selection of the most promising concept and its evaluation in the ISX-C device under the following conditions: (1) quasi steady state operation ($\leqq$ 30s), (2) high edge power densities, and (3) particle control by means of mechanical devices. We are considering various options, including particle scraper and ballistic particle collection concepts as well as the current FED design. In ISX-B we will test a full-size pump limiter and directly compare the heat removal and particle control capabilities with a bundle divertor. In ISX-C the steady state operation characteristics of pump limiters will be explored.

32733 (CONF-810831—20) Recent results on the gettering of tritium from molten lithium. Talbot, J.B.; Fisher, P.W.; Clinton, S.D.;. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE81028214.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Recent sorption experiments confirm that the mass transfer resistance in the yttrium solid phase controls the rate of tritium uptake from liquid lithium. Physical and chemical characteristics of different yttrium sorbers were measured to identify those properties that have the greatest effect on the tritium recovery rate. The BET surface areas of the five samples tested ranged from 0.005 to 0.4 m^2/g; concentrations of carbon, hydrogen, nitrogen, and oxygen impurities in the sample lots increased with increasing surface area. The sample showing the highest effective sorption rate had the largest surface area but also contained the highest concentration of impurities.

32734 (CONF-810831—24) Spectral tailoring for fusion radiation-damage studies: where do we stand. Gabriel, T.A.; Lillie, R.A.; Thoms, K.; Childs, R.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE81028568.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The Oak Ridge Research Reactor is currently being used to irradiate an experiment (MFE-4A) to simulate in stainless steel-316 the He to DPA ratio of 14 appM He/DPA expected at the first wall of a fusion reactor. The experimental design criterion is to remain within +- 20% of this ratio after an initial irradiation period of ~ 1.2 years. At present (March 31, 1981) the experiment has been in the reactor for 19 cycles corresponding to 131,543 Mwh, 4.05×10^{25} n/m^2 in thermal fluence, 1.21×10^{26} n/m^2 in total fluence, 3.1 DPAs and 21.0 appM He. The current He to DPA ratio is 6.8. This paper summarizes some of the analysis calculations for this experiment and presents the current status of this work. The analysis calculations utilize the codes VENTURE, ANISN, GAS, UNFOLD, etc. and the obtained results include gas production, DPA, and heating rates, and neutron spectral modifications resulting from different reactor fuel loadings and core piece compositions.

32735 (CONF-810831—37) Characteristics of irradiation creep in the first wall of a fusion reactor. Coghlan, W.A.; Mansur, L.K. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE81028430.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

A number of significant differences in the irradiation environment of a fusion reactor are expected with respect to the fission reactor irradiation environment. These differences are expected to affect the characteristics of irradiation creep in the fusion reactor. Special conditions of importance are identified as the (1) large number of defects produced per pka, (2) high helium production rate, (3) cyclic operation, (4) unique stress histories, and (5) low temperature operations. Existing experimental data from the fission reactor environment is analyzed to shed light on irradiation creep under fusion conditions. Theoretical considerations are used to deduce additional characteristics of irradiation creep in the fusion reactor environment for which no experimental data are available.

32736 (CONF-810835—3) Steady-state heat transfer to boiling liquid helium in simulated coil windings. Walstrom, P.L. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE81028561.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The present data show that the worst case steady-state stability in the GE/LCT magnet windings is at a horizontal conductor orientation. The heat transfer improves with inclination of the conductor from horizontal. Calculations show that for these small regions normal zones will recover by cold-end conduction from the inclined conductor on either end.

32737 (CONF-810835—8) Development of force-cooled superconductors for use in large magnets. Miller, J.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE81028067.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Force-cooled conductors or ICSs offer an attractive option for designers of large magnets. Knowledge of the performance of this type of conductor has advanced sufficiently in recent years for reliable designs to be made. Preliminary designs can be made with the help of relatively simple formulae and a rather extensive data base from small conductor tests.

32738 **(CONF-810852—1) Radiation facilities for fusion reactor first wall and blanket structural materials development.** Klueh, R.L.; Bloom, E.E. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 66p. NTIS, PC A04/MF A01. Order Number DE81028063.

From Seminar on radiation behavior of materials and its impact on fusion reactor design; Paris, France (24 Aug 1981).

Present and future irradiation facilities for the study of fusion reactor irradiation damage are reviewed. Present studies are centered on irradiation in accelerator-based neutron sources, fast- and mixed-spectrum fission reactors, and ion accelerators. The accelerator-based neutron sources are used to demonstrate damage equivalence between high-energy neutrons and fission reactor neutrons. Once equivalence is demonstrated, the large volume of test space available in fission reactors can be used to study displacement damage, and in some instances, the effects of high-helium concentrations and the interaction of displacement damage and helium on properties. Ion bombardment can be used to study the mechanisms of damage evolution and the interaction of displacement damage and helium. These techniques are reviewed, and typical results obtained from such studies are examined. Finally, future techniques and facilities for developing damage levels that more closely approach those expected in an operating fusion reactor are discussed.

32739 **(DOE/DP/40107—1) Key technical issues associated with a method of pulse compression. Final technical report.** Hunter, R.O. Jr. (Western Research Corp., San Diego, CA (USA)). Jun 1980. Contract AC08-79DP40107. 281p. NTIS, PC A13/MF A01. Order Number DE81029774.

Key technical issues for angular multiplexing as a method of pulse compression in a 100 KJ KrF laser have been studied. Environmental issues studied include seismic vibrations man-made vibrations, air propagation, turbulence, and thermal gradient-induced density fluctuations. These studies have been incorporated in the design of mirror mounts and an alignment system, both of which are reported. A design study and performance analysis of the final amplifier have been undertaken. The pulse compression optical train has been designed and assessed as to its performance. Individual components are described and analytical relationships between the optical component size, surface quality, damage threshold and final focus properties are derived. The optical train primary aberrations are obtained and a method for aberration minimization is presented. Cost algorithms for the mirrors, mounts, and electrical hardware are integrated into a cost model to determine system costs as a function of pulse length, aperture size, and spot size.

32740 **(DOE/ER/10698—1) Cryogenic polarized-target facility. Progress report, July 1, 1980-June 30, 1981.** Gould, C.R.; Haase, D.G. (North Carolina State Univ., Raleigh (USA)). 1981. Contract AS05-80ER10698. 13p. NTIS, PC A02/MF A01. Order Number DE81028912.

The goal of this three year research project is to build a cryogenically polarized target facility, and to measure the total neutron cross sections for polarized neutrons incident on polarized nuclie. The experiments will be performed with 2 to 20 MeV polarized neutrons at Triangle Universities Nuclear Laboratory. Construction of the polarized target faciity requires assembling a helium dilution refrigerator and superconducting magnet system capable of coolng metallic targets to a temperature of 10 mK in magnetic fields of about 7 Tesla. The superconducting magnet and the pumping system for the dilution regrigerator have been delivered. The dewar is under construction in-house. The complete system is scheduled for testing Fall 81. A dedicated beam line is being set up and includes a shielded neutron detector, a collimator for the incoming neutron beam, and source shielding to reduce room background neutrons to a minium. First experiments with aluminum and copper and are scheduled for early next year.

32741 **(DOE/ET/51013—5) Constance mirror program: progress and plans.** Klinkowstein, R.E.; Mauel, M.E.; Irby, J.; Smullin, L.D.; Voldman, S. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 3 Mar 1981. Contract AC02-78ET51013. 89p. NTIS, PC A05/MF A01. Order Number DE81029962.

The basic construction of the Constance II experiment was completed during August of 1979 with the installation of the first set of Ioffe bars. Since then, several improvements have been made and several experimental investigations have been completed. These are: (1) the improved, liquid-nitrogen cooled, Ioffe bars have been constructed and installed, (2) a diverter coil was installed between the guide and mirror field region, (3) the 100 kW ICRF generator have been constructed and tested, (4) the data acquisition system has been completed, (5) confinement studies have determined the optimum hot-ion operation of the machine with Titanium and pulsed-gas plasma guns, (6) the density, temperature, and radius of the plasma have been measured, (7) ion-cyclotron fluctuations have been observed, their bandwidth measured, and the conditions for its appearance investigated, and (8) preliminary ECRH data have been collected demonstrating resonance heating. In addition, development of the diagnostics has continued. For example, new x-ray diagnostics have been designed and purchased, and progress on the Thomson scattering has been made. Finally, a new hot cathode gun, which will soon be tested, has been designed and constructed. This report discusses the current state of the mechanics of the Constance II experiment as well as the physics results that have been gathered to date. In addition, the motivation, background, and future plans for the Constance II experiment will be reviewed.

32742 **(DOE/ET/51013—T1) Novel limiter pump topologies.** Schultz, J.H. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center; Oak Ridge National Lab., TN (USA)). 1981. Contract AC02-78ET51013. 33p. (PFC/RR—81-4). NTIS, PC A03/MF A01. Order Number DE81029436.

The use of limiter pumps as the principle plasma exhaust system of a magnetic confinement fusion device promises significant simplification, when compared to previously investigating divertor based systems. Further simplifications, such as the integration of the exhaust system with a radio frequency heating system and with the main reactor shield and structure are investigated below. The integrity of limiters in a reactor environment is threatened by many mechanisms, the most severe of which may be erosion by sputtering. Two novel topolgies are suggested which allow high erosion without limiter failure.

32743 **(DOE/ET/53088—15) Dynamic magnetic x-points.** Leboeuf, J.N.; Tajima, T.; Dawson, J.M. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Mar 1981. Contract FG05-80ET53088. 63p. NTIS, PC A04/MF A01. Order Number DE81029830.

Two-and-one-half dimensional magnetostatic and electromagnetic particle simulations of time-varying magnetic x-points and the associated plasma response are reported. The stability and topology depend on the crossing angle of the field lines at the x-point, irrespective of the plasma β. The electrostatic field and finite Larmor radius effects play an important role in current penetration and shaping of the plasma flow. The snapping of the field lines, and dragging of the plasma into, and confinement of the plasma at, an o-point (magnetic island) is observed. Magnetic island coalescence with explosive growth of the coalescence mode occurs and is accompanied by a large increase of kinetic energy and temperature as well as the formation of hot tails on the distribution functions.

32744 **(GA-A—16407) Irradiation study of lithium compound samples for tritium-breeding application.** Yang, L.; Medico, R.; Baugh, W.; Schultz, K. (General Atomic Co., San Diego, CA (USA)). Jul 1981. Contract AT03-76ET51011. 8p. (CONF-810831—12). NTIS, PC A02/MF A01. Order Number DE81028602.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

Fifty-four Inconel-600 clad $LiAlO_2$, Li_2O, Li_4SiO_4 and Li_7Pb_2 samples were prepared and irradiated in the Oak Ridge Reactor at 600° to 1000°C for a period of about six months to a fast neutron fluence ($>$ 0.18 MeV) of 1.1 to 2.7 x 10^{25} n/m^2. This paper describes the fabrication techniques for these samples and the post-irradiation examination results of the microstructures of these compounds and their compatibility with the cladding material.

32745 (GA-A—16429) Changes in near-surface microstructure of metallic limiters following one year of service in Doublet III. Trester, P.W.; Sevier, D.L.; Sabado, M.M. (General Atomic Co., San Diego, CA (USA)). Aug 1981. Contract AT03-76ET51011. 7p. (CONF-810831—35). NTIS, PC A02/MF A01. Order Number DE81029487.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The structural alloys Ta-10W, Mo, and Inconel X-750 were used for plasma limiters during the 3-MW ohmic heating experiments of the Doublet III tokamak. Post-service examinations of these limiters are reviewed. Near-surface melting, cracking, and microstructural changes are shown and discussed. During III service, elements from other metallic components were transported by the plasma and deposited on the limiter surface; significantly, high concentrations of Ni, Fe, Mo, and C were detected in the regions found to be microcracked in the Ta-10W. Observations and analyses are made that are relevant to the design of limiter and armor components for larger tokamaks.

32746 (HEDL-SA—2311-FP) Remote-maintenance features of the Fusion Materials Irradiation Test (FMIT) facility lithium system. Kelly, V.P. (Hanford Engineering Development Lab., Richland, WA (USA)). 4 May 1981. Contract AC14-76FF02170. 32p. (CONF-810606—87). NTIS, PC A03/MF A01. Order Number DE81027847.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

The FMIT Facitlity has been redesigned to allow remote maintenance of lithium system components such as the main lithium pump, heat exchanger, traps, and valves. Remote versus contact maintenance is required due to the limited effectiveness of methods planned for control of the radioisotope ^{7}Be which is formed in the lithium during the neutron generating process. The altered FMIT arrangement provides cubicles for isolation of the main pump and system dump valve to allow personnel access for completing welds on large diameter piping after replacing failed components. Maintenance on other components such as the main heat exchanger and traps will be done remotely. The resulting arrangement provides full capability to meet the required facility availability criteria with minimum impact on the facility and with minimum associated development costs.

32747 (HEDL-SA—2401-FP) Status of FMIT. Trego, A.L.; Parker, E.F.; Hagan, J.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1981. Contract AC14-76FF02170. 12p. NTIS, PC A02/MF A01. Order Number DE81029778.

The Fusion Materials Irradiation Test (FMIT) Facility is a high-flux, high-energy neutron source that will provide a fusion-like radiation environment for fusion reactor materials develoment. The neutrons will be produced in a nuclear stripping reaction by impinging a 35 MeV beam of deuterons from an Alvarez-type linear accelerator on a flowing lithium target. The target will be located in a test cell and will provide an irradiation volume of 10 cm^3 at an average neutron flux of greater than 1.4 x 10^{15} n/cm^2-s and 500 cm^{3-} at an average flux of greater than 2.2 x 10^{14} n/cm^2-s. This irradiation test volume will be at least 500 times larger than that of any other facility with comparable neutron energy and flux.

32748 (IPP—2/254) Stellarators: status and future directions. Joint US-EURATOM report. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jul 1981. 112p. NTIS, PC A06/MF A01. Order Number DE81026572.

Some of the special properties of stellarators are pointed out. Recent advances, future tasks, recommendations, and the role of stellarators in the fusion program are discussed. (MOW)

32749 (LA—8914-MS) Power-crowbar impacts on plasma characteristics in ZT-40. Watt, R.G. (Los Alamos Scientific Lab., NM (USA)). Jul 1981. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01. Order Number DE81027935.

Detailed analysis of the impact of I/sub phi/ and I/sub θ/ power crowbars on the ZT-40 plasma is presented for the operational period between shots 1620-3600. It is demonstrated that in both aided- and self-reversed modes the main effect of the I/sub phi/ power crowbar is to lengthen the time to I/e of peak current, whereas the main effect of the I/sub θ/ power crowbar is to extend the reversal of B/sub phi/ at the wall, primarily in self-reversed operation. It is shown that this extension has the effect of also decreasing the current decay rate to the point where no distinction is seen between the two modes. A saturation is seen in the decay time (tau/sub I/e/ $\leqq$ 0.4 ms) once the field reversal in either mode exceeds approximately 0.3 ms. Possible physical explanations of these effects are discussed.

32750 (LA-UR—81-2295) Use of the LAMPF accelerator as a fusion materials-radiation facility. Sommer, W.F.; Kmetyk, L.N.; Green, W.V.; Damjanovich, R. (Los Alamos National Lab., NM (USA); Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01. Order Number DE81028702.

Materials for fusion applications will be subjected to radiation that produces large amounts of transmutation product gases such H and He, as well as others. These gaseous products can have a marked influence on material mechanical properties as they affect the microstructural evolution of the material. Previous calculations by others have shown that the 800 MeV proton beam at the Clinton P. Anderson Los Alamos Meson Physics Facility (LAMPF) will produce gaseous transmutation products in amounts near those expected in the fusion environment. This report will survey the LAMPF facility from the standpoint of experiment design, temperature control, available experimental volume and available beam time. Calculations have been made that predict that attainable displacement rates at specific available target stations at LAMPF. Results for W, Mo, Al and stainless steel will be reported.

32751 (LBL—12409) 3-megajoule heavy-ion fusion driver. Faltens, A.; Hoyer, E.; Keefe, D. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 12p. (CONF-810620—16). NTIS, PC A02/MF A01. Order Number DE81028875.

From 4. international topical conference on high-power electron and ion-beam research and technology; Palaiseau, France (29 Jun 1981).

The initiation of inertial confinement fusion reactions with a heavy ion particle beam has been under intensive study since 1976, and the progress of this study is principally documented in the proceedings of annual workshops held by US National Laboratories. At this time a 3MJ, 150 TW, ion beam is a good choice to initiate microexplosions with energy gain of 100. The Lawrence Berkeley Laboratory has made systems studies based on a Linear Induction Accelerator to meet the beam requirements. The accelerator system, expected performance and cost, and technical problems to be addressed in the near future are discussed.

32752 (LBL—12711) ACDOS2: an improved neutron-induced dose rate code. Lagache, J.C. (Lawrence Berkeley Lab., CA (USA)). Jun 1981. Contract W-7405-ENG-48. 139p. NTIS, PC A07/MF A01. Order Number DE81029845.

Thesis.

To calculate the expected dose rate from fusion reactors as a function of geometry, composition, and time after shutdown a computer code, ACDOS2, was written, which utilizes up-to-date libraries of cross-sections and radioisotope decay data. ACDOS2 is in ANSI FORTRAN IV, in order to make it readily adaptable elsewhere.

32753 (LBL—13034) Cryopump operations with the tokamak neutral-beam-injector prototype. Byrns, R.A.; Newell, G.A. (Lawrence Berkeley Lab., CA (USA)). Jul 1981. Contract W-7405-ENG-48. 9p. (CONF-810835—14). NTIS, PC A02/MF A01. Order Number DE81028133.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The various components of the cryosystem are briefly discussed. They are: cryopanels and heat loads, divertor valve, and vacuum pumping system. In addition, some operations of the system are described. (MOW)

32754 **(ORNL/TM—7746) Equilibrium field coil concepts for INTOR.** Strickler, D.J.; Peng, Y.K.M.; Brown, T.G. (Oak Ridge National Lab., TN (USA); Grumman Aerospace Corp., Bethpage, NY (USA)). Aug 1981. Contract W-7405-ENG-26. 48p. NTIS, PC A03/MF A01. Order Number DE81028032.

Methods are presented for reducing ampere-turn requirements in the EF coil system. It is shown that coil currents in an EF coil system external to the toroidal field coils can be substantially reduced by relaxing the triangularity of a D-shaped plasma. Further reductions are realized through a hybrid EF coil system using both internal and external coils. Equilibrium field coils for a poloidally asymmetric, single-null INTOR configuration are presented. It is shown that the shape of field lines in the plasma scrapeoff region and divertor channel improves as triangularity is reduced, but it does so at the possible expense of achievable stable beta values.

32755 **(ORNL/TM—7885) Improvement of gas efficiency of negative ion sources.** Whealton, J.H. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE81028031.

A modification of the currently operating Calutron, magnetron, and modified duoPIGatron negative ion source is proposed. The modification should improve gas efficiency by more than an order of magnitude in the Calutron, by a factor of 5 in the magnetron, and by a factor of 2 in the duoPIGatron.

32756 **(PPPL—1818) Ripple transport and the depletion of energetic particles in tokamaks.** Linsker, R.; Boozer, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1981. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01. Order Number DE81025935.

A local velocity-diffusion model is used to estimate the ripple transport-induced deviations from a Maxwellian distribution and the effects of such deviations on confinement time and reactivity.

32757 **(SAND—81-0230C) Thermal-fatigue properties of coated materials for fusion device applications.** Mullendore, A.W.; Whitley, J.B.; Mattox, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 10p. (CONF-810831—21). NTIS, PC A02/MF A01. Order Number DE81028367.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

The adherence of plasma sprayed coatings of TiC, VC, TiB_2 and B on substrates of Cu, 316 SS, Mo, Ta and Poco AXF-5Q artificial graphite has been evaluated in a pulsed electron beam, thermal fatigue environment. The materials are candidates for application as limiter and armor components of tokamak fusion devices. Up to 500 cycles of heating at power densities of 1.5 kW/cm^2 for 1.5 sec. were used. Materials were tested both in the as-sprayed (19 to 33% porosity) condition and after hot isostatic pressing (HIP) to increase coating density. Some (e.g. TiC on Mo and Ta) showed good survivability in both the as-sprayed and HIP densified conditions. TiB_2 on Mo and Ta and VC on Poco graphite were improved while TiC + V on Mo and Ta were degraded by the HIP treatment.

32758 **(SAND—81-0580C) Continuously variable electrooptic filter.** Whitley, J.B.; Cuthrell, R.E.; Mattox, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 4p. (CONF-810810—7). NTIS, PC A02/MF A01. Order Number DE81025393.

From SPIE international symposium; San Diego, CA, USA (24 Aug 1981).

A PLZT electrooptic filter is being used to control the intensity of light transmitted to a video camera from samples undergoing pulsed electron beam thermal testing. This electron beam test system is part of a materials development program for fusion energy applications. During the testing, sample surface temperatures may reach 3000°C and the intense light from these pulses is potentiallly damaging to the camera. The use of a variable density electrooptic filter prevents this damage and provides improved image quality during rapid changes of surface temperature.

32759 **(SAND—81-0622) Potential for T buildup in the INTOR liner.** Doyle, B.L. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01. Order Number DE81029878.

The retention and release of hydrogen isotopes implanted into several low Z materials proposed for surfaces in tokamaks subjected to high-power deposition have been studied. The results of these experiments are summarized and the implications of these measurements are examined with respect to T buildup in the proposed graphite liner for INTOR.

32760 **(SAND—81-0785C) PBFA I: pulsed power driver for inertial confinement fusion.** VanDevender, J.P.; Barr, G.W.; Crow, J.T. (Sandia National Labs., Albuquerque, NM (USA); Pulse Sciences, Inc., Alameda, CA (USA)). Jun 1981. Contract AC04-76DP00789. 16p. (CONF-810620—15). NTIS, PC A02/MF A01. Order Number DE81028647.

From 4. international topical conference on high-power electron and ion-beam research and technology; Palaiseau, France (29 Jun 1981).

The PBFA I accelerator has been tested and is operational at its full power rating of 30 TW. The PBFA I experiments demonstrated that the multimodular approach to superpower generators is viable. The modular outputs can be combined in parallel or series-parallel combinations of the magnetically insulated transmission lines to power single, ion-beam diodes or imploding plasma sources. The coupling efficiency between the magnetically insulated transmission lines for time varying loads is less efficient than it is for ordinary transmission lines.

32761 **(SAND—81-0842C) Low-energy x-ray emission from light ion targets.** Mix, L.P.; Burns, E.J.T.; Fehl, D.L.; Hanson, D.L.; Johnson, D.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-77DP00789. 14p. (CONF-810651—5). NTIS, PC A02/MF A01. Order Number DE81028249.

From 1981 topical conference on low-energy X-ray diagnostics; Livermore, CA, USA (8 Jun 1981).

The light ion fusion program is expected to achieve breakeven conditions in an inertial fusion target in experiments on the PBFA II acclerator. This goal is expected to require ion power densities of $\sim < 10^{14}$ W/cm^2. The diagnostics which have been employed to diagnose this disposition are described and some soft x-ray plasma measurements which have been made on targets on the 200 times smaller Proto I acclerator are presented. Plasma brightness temperatures of 20 eV have been observed in the deposition region and 35 eV (100 eV electron temperature) in the stagnation region of imploding conical Al targets on Proto I.

32762 **(UCRL—15376) Options: the JADE reactor and heat transfer by heat pipes.** Simpson, J.E.; Massey, J.V. (Lawrence Livermore National Lab., CA (USA); Bechtel Group, Inc., San Francisco, CA (USA)). 10 Aug 1981. Contract W-7405-ENG-48. 5p. (CONF-811103—40). NTIS, PC A02/MF A01. Order Number DE81030068.

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

The JADE reactor is a new Lawrence Livermore National Laboratory (LLNL) concept which maintains advantages of liquid metal walls and addresses some of their problems. The concept envisions a porous medium, called the jade, of specific geometry lining the reactor cavity. The jade is designed to convert the kinetic energy of the fluid to thermal energy before it reaches the first wall. Finally, its particular geometric shape is used to minimize reaction forces on the first wall due to blow-off caused by soft x-rays and debris, to provide empty spaces for fluid expansion after neutron energy deposition where droplets collide with droplets cancelling their kinetic energies, and to provide large surface areas for rapid condensation of vapor. LLNL also suggested that heat pipes might be used to eliminate portions of the primary or secondary coolant loops, thereby reducing pumping requirements found in current reactor designs.

32763 (UCRL—84974) Progress toward fusion energy. Thomassen, K.I. (Lawrence Livermore National Lab., CA (USA)). 11 Mar 1981. Contract W-7405-ENG-48. 8p. (CONF-810808—5). NTIS, PC A02/MF A01.

From Energy in the man-built environment: the next decade specialty conference; Vail, CO, USA (3 Aug 1981).

This paper summarizes the basis for the present optimism in the magnetic fusion program, and describes some of the remaining tasks leading to a demonstration power reactor and the primary technologies necessary for that endeavor.

32764 (UCRL—85722) Fast, versatile pockels cell driver. Oicles, J.A.; Downs, D.C.; Kuizenga, D.J. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1981. Contract W-7405-ENG-48. 5p. (CONF-810659—23). NTIS, PC A02/MF A01. Order Number DE81024365.

From 3. IEEE international pulsed power conference; Albuquerque, NM, USA (1 Jun 1981).

Vacuum planar triodes, normally used in S-Band radar applications, can also serve as excellent switch tubes in fast, low jitter pulse generators. Laser systems have need of such generators for driving Pockels cells. Development work in this area has resulted in three successive driver designs. The present two-chassis unit will serve as a standard driver in the Nova and Novette laser systems. This assembly is capable of driving nine kilovolts into 75 ohms with three nanoseconds risetime and less than 100 picoseconds short term jitter. Rise and fall times of approximately two nanoseconds are available at half output voltage swing.

32765 (UCRL—85723) Performance and cost analysis of large capacitor banks using Weibull statistics and MTBF. Merritt, B.T.; Whitham, K. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1981. Contract W-7405-ENG-48. 5p. (CONF-810659—21). NTIS, PC A02/MF A01. Order Number DE81024364.

From 3. IEEE international pulsed power conference; Albuquerque, NM, USA (1 Jun 1981).

Inertial confinement fusion projects have required increasingly larger capacitor banks. As bank size has increased, the need for high energy density capacitors has become apparent. Higher energy densities are achieved by increasing the dielectric stress while reducing life. Acceptable capacitor life is based on system MTBF. For Nova, a 100 shot MTBF was deemed to be minimum. For a large population of capacitors, as in Nova, statistical analysis is required to evaluate system performance. The tradeoff between capacitor life and energy density can be characterized via Weibull statistics. A method of calculating capacitor bank reliability and capacitor bank costs based on Weibull statistics is given herein.

32766 (UCRL—86046) X-ray microscopy using grazing-incidence reflection optics. Price, R.H. (Lawrence Livermore National Lab., CA (USA)). 6 Aug 1981. Contract W-7405-ENG-48. 13p. (CONF-810651—6). NTIS, PC A02/MF A01. Order Number DE81028160.

From 1981 topical conference on low-energy X-ray diagnostics; Livermore, CA, USA (8 Jun 1981).

The Kirkpatrick-Baez microscopes are described along with their role as the workhorse of the x-ray imaging devices. This role is being extended with the development of a 22X magnification Kirkpatrick-Baez x-ray microscope with multilayer x-ray mirrors. These mirrors can operate at large angles, high x-ray energies, and have a narrow, well defined x-ray energy bandpass. This will make them useful for numerous experiments. However, where a large solid angle is needed, the Woelter microscope will still be necessary and the technology needed to build them will be useful for many other types of x-ray optics.

32767 (WFPS-TME—81-011) Coating requirements for an ICF dry-wall design. Taylor, L.H.; Sucov, E.W. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Fusion Power Systems Dept.). 30 Jun 1981. Contract AC08-79DP40086. 7p. (CONF-810831—38). NTIS, PC A02/MF A01. Order Number DE81028045.

From Fusion reactor materials meeting; Seattle, WA, USA (9 Aug 1981).

A new concept for protecting the first wall of an ICF reactor has been developed which relies heavily on a coating to protect the steel tubes which comprise the first wall. This coating must survive the pellet explosion, be ductile, and be compatible with the materials in the ICF pellet. Calculations indicate that tantalum is the best choice for the coating material and that tantalum coated steel tubes can handle fusion thermal powers of 3500 MW in a 10 m radius spherical chamber.

32768 Electron temperature requirements for ballistically focused neutralized ion beams. Lemons, D.S.; Thode, L.E. (Los Alamos Scientific Lab., NM (USA)). *Nuclear Fusion ;* **21**: No. 5, 529-535(May 1981).

An envelope equation, based on a self-consistent equilibrium model of a charge- and current-neutralized, ballistically focused ion beam is derived. Focusing of the beam is limited by electrostatic fields within a Debye sheath at the beam edge and residual electrostatic fields within the beam interior. Numerical and approximate analytical solutions indicate that the initial temperature of the neutralizing electrons must be less than about 10 keV in heavy-ion inertial-confinement fusion systems of fewer than ten beams.

32769 (LA-tr—81-22) Report of laser activities, 1978-1979. Sitt, B.; Berthier, E.; Buresi, E.; Wilke, N. (Los Alamos National Lab., NM (USA)). 1981. Translation of CEA-N—2163, September 1980. 11p. NTIS, PC A02/MF A01. Order Number DE81028997.

A discussion is given of hydromagnetic instabilities upon implosion of laser targets. Some simplified numerical models of imploded DT targets were used in the study. (MOW)

32770 Results of hydrogen pellet injection into ISX-B. Milora, S.L.; Foster, C.A.; Thomas, C.E. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion ;* **20**: No. 12, 1491-1514(Dec 1980).

35 refs.

High-speed pellet fuelling experiments have been performed on the ISX-B device in a new regime characterized by large global density rise in both Ohmically and neutral-beam heated discharges. Hydrogen pellets of 1 mm in diameter were injected in the plasma midplane at velocities exceeding 1 $km.s^{-1}$. In low-temperature Ohmic discharges, pellets penetrate beyond the magnetic axis, and in such cases a sharp decrease in ablation is observed as the pellet passes the plasma centre. This behaviour can be accounted for by an ablation model that includes dynamic cooling of the target plasma while the ablation proceeds. Complete penetration can be prevented by operation in low-density regimes where runaway electrons are thought to be responsible for high ablation. A similar effect is observed with moderate to large amounts of neutral-beam injection. There is a strong enhancement of the ablation rate in the outer 10-cm plasma region even for short heating intervals, which can be explained by the presence of multi-kilo-electron volt ions in the discharge. Density increases of approximately 300% have been observed without degrading plasma stability or confinement. Energy confinement time increases in agreement with the empirical scaling tausub(E) approximately nsub(e) and central ion temperature increases as a result of improved ion-electron coupling. Laser-Thomson scattering and radiometer measurements indicate that the pellet interaction with the plasma is adiabatic. The low level of power emission from the pellet-plasma interaction region is consistent with negligible charge-exchange losses; within the experimental accuracy, nearly all of the pellet mass can be accounted for in the initial plasma density rise. Penetration to r/a approximately 0.15 is optimal, in which case large-amplitude sawtooth oscillations are observed and the density remains elevated.

32771 Intense pulsed ion beams for fusion applications. Humphries, S. Jr. (Sandia Labs., Albuquerque, NM (USA)). *Nuclear Fusion ;* **20**: No. 12, 1549-1612(Dec 1980).

278 refs.

The subject of this review is the field of intense pulsed ion beam generation and its potential application to fusion research. Considerable progress has been made in the past six years. Power levels of the order of 1000 MW/cm^2 have been obtained for pulse-lengths from 10^{-8} to 10^{-6} s. Light-ion beams with currents approaching 1 MA and energies exceeding 1 MeV have been produced. The first half of the paper treats the physics and technology of beam generation. Following a unified discussion of the theory of

ion injectors, experimental work since 1973 is reviewed. Diagnostic techniques appropriate to high-flux ion beams are summarized. The general problem of high-current ion beam transport in vacuum and through plasmas is also considered. The second part of the paper is devoted to applications to fusion research. Applications in both magnetic confinement and inertial confinement fusion are considered. Intense ion beams have a number of features which make them ideally suited as inertial fusion drivers. Discussions are given of the physics of inertial fusion targets, options for ion beam production, experiments on light-ion beam focusing, and high-current multi-stage accelerators.

32772 **Safety and reliability in superconducting fusion magnet systems.** Hsieh, S.Y.; Laverick, C.; Powell, J.R.; Reich, M. (Brookhaven National Lab., Upton, NY (USA)). *Cryogenics ;* **20**: No. 10, 575-586(Oct 1980).

Superconducting toroidal field coils for future commercial Tokamak reactors must operate safely and reliably for periods of up to 30 years or more with minimal interruption for maintenance. This paper represents an initial attempt to consider safety and reliability issues for superconducting fusion magnets. Goals and approaches for safety and reliability are characterized. Possible accident initiators are identified, and the effect of mechanical, thermal, and electrical factors are examined, by using some early Tokamak reactor concepts as illustrations. Principal factors in magnet instrumentation and control are identified, and the role of engineered-safety features are discussed.

32773 **Observation of anomalously broad Gaussian HeII 4686 A spectral lines in Tormac.** Shaw, R.S.; Coonrod, J.; Greenwald, M.; Levine, M.A.; Myers, B.R.; Vella, M.C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Plasma Physics ;* **22**: No. 8, 843-849(Aug 1980).

Gaussian HeII 4686 A spectral lines having full widths at half maximum of over 2A have been observed in the Tormac plasmas. Interpretation of these widths as due to Doppler broadening would give ion temperatures of >100 eV, in contradiction with other diagnostics. Indications are that these widths are not simply explained by either Doppler broadening or Stark broadening due to interparticle fields. Some evidence exists of nonthermal turbulent conditions, which could broaden the lines by the Stark effect, if there exist large enough electric fields, or by the Doppler effect, if there is appreciable mass motion.

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32774 **(JPRS—78585) China report: Science and Technology, No. 112.** (Joint Publications Research Service, Arlington, VA (USA)). 23 Jul 1981. Translation of various articles. 69p. NTIS. Order Number DE81903565.

English translations are presented of eight articles published in China during 1980 or 1981 on nuclear power plant planning; a Chinese language computer; digital processing of remotely sensed data; metallurgy; mineralogy; and new cosmic dust discovered in the atmosphere. The content of 4 journals published in 1981 are listed and abstracts of journal articles on metallurgy and solar energy are presented. (LCL)

9901 Management

REFER ALSO TO CITATION(S) 32098, 32132, 32284

32775 **(CONF-800820—13) Business performance and vertical integration.** Maddigan, R.J. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 28p. NTIS, PC A02/MF A01. Order Number DE81028531.

From American Statistical Society meeting; Houston, TX, USA (11 Aug 1980).

The focus of this empirical study is the relationship between vertical integration, as an element of market structure, and the price-cost margin, as a component of a firm's performance. The models presented in this paper differ from previous efforts because vertical integration is measured by the Vertical Industry Connections (VIC) index. VIC is defined as a function of the relative net interactions among the industries in which a firm operates. The results indicate that VIC is significant in increasing th price-cost margin, supporting the hypothesis that vertical intergration can be employed as a strategy to enhance business performance.

32776 **(CONF-810848—1) Credible baseline analysis for multi-model public policy studies.** Parikh, S.C.; Gass, S.I. (Oak Ridge National Lab., TN (USA); Maryland Univ., College Park (USA)). 1981. Contract W-7405-ENG-26. 38p. NTIS, PC A03/MF A01. Order Number DE81028215.

From International Institute for Applied Systems Analysis workshop on model validity and credibility; Vienna, Austria (4 Aug 1981).

The nature of public decision-making and resource allocation is such that many complex interactions can best be examined and understood by quantitative analysis. Most organizations do not possess the totality of models and needed analytical skills to perform detailed and systematic quantitative analysis. Hence, the need for coordinated, multi-organization studies that support public decision-making has grown in recent years. This trend is expected not only to continue, but to increase. This paper describes the authors' views on the process of multi-model analysis based on their participation in an analytical exercise, the ORNL/MITRE Study. One of the authors was the exercise coordinator. During the study, the authors were concerned with the issue of measuring and conveying credibility of the analysis. This work led them to identify several key determinants, described in this paper, that could be used to develop a rating of credibility.

32777 **(MIT-EL—79-043) Standards, warranties, and commercialization of new energy technologies.** Bottaro, D. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Nov 1979. Contract AC02-76ET20279. 45p. NTIS, PC A03/MF A01. Order Number DE81029704.

This paper shows that the effects of standards and warranties can be systematically analyzed for use in commercialization programs. While the analysis is qualitative, it has substantive content and provides a framework of reference for evaluating particular standards and warranties and efforts for their development. The general conclusion to be drawn concerning commercialization efforts is to allow standards and warranties to develop by the voluntary consensus process as the technology matures and the information collected will permit. Though the field is understudied, it is not intractable. Given the increasing use of standards and warranties as policy tools, it is hoped that more academic efforts will address the subject.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 31706, 32289, 32370, 32387, 32525

32778 **(ANL—81-49) Secondary states of vibrating plates.** Matkowsky, R.J.; Putnick, L.J.; Reiss, E.L. (Argonne National Lab., IL (USA)). Aug 1981. Contract W-31-109-ENG-38. 25p. NTIS, PC A02/MF A01. Order Number DE81029961.

A previously developed perturbation method is used to obtain a new class of periodic motions for the nonlinear vibrations of rectangular, elastic plates. The dynamic von Karman plate theory is used in the analysis. The new solutions arise by secondary bifurcation from the periodic solutions that bifurcate from the natural frequencies of free vibrations of the linearized plate theory. The new motions are a linear combination of two modes of the linearized theory.

32779 **(CONF-810842—1) Preliminary internal data screening: a component of quantitative data analysis in data vaidation.** Pack, D.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 31p. NTIS, PC A03/MF A01.

From American Statistical Association meeting; Detroit, MI, USA (10 Aug 1981).

Internal data screening is validation of data by quantitative internal comparisons across records for a given variable, across variables for a given record, across time for a given variable and record, etc. Preliminary internal data screening has the objectives

of producing: (1) a frozen, archived data base ready for efficient computer analysis; and (2) a general understanding of key variables, a rough cut at response meaningfulness, a qualification of the type of error present, and an assessment of the expected level of difficulty in the comprehensive validation. The relatively less important first objective is defined. It is seen to be achievable through simple computer methodology. The second objective is the paper's major focus. Initial methodological suggestions for accomplishing this objective centering upon the exploratory data analysis techniques of Tukey are made, recognizing these techniques' appropriateness for a general examination of a large data base that may contain numerous errors.

32780 **(DOE/ER/01388—494) Memory expansion hardware for PSP11 computers.** Seymour, R.J. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1981. Contract AC06-76ER01388. 5p. (CONF-810523—12). NTIS, PC A02/MF A01. Order Number DE81028322.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

Two hardware methods have been developed to expand MULTI's data storage region. They are usable by any UNIBUS PDP-11 program needing rapid random access to large data areas. The first, known as a Bus Mirror, is a modified DEC DR-11-B (DECKit 11-D) wired to allow program controlled modification of any location on the PDP11's UNIBUS. It performs and reads and writes in a DMA mode, and does not require use of CED's slow PLAS system directives. The second, known as Dataspace Memory, is a modified Plessey memory board operating like the Bus Mirror. It provides 64k words of additional storage on the UNIBUS, invisible to the normal UNIBUS addressing scheme. This has given us a PDP 11/60 with 188k words of memory, with a design limit of 33 megawords. These devices have brought our usable MULTI data space from 6k words to 24k words to 64k words.

32781 **(DOE/ER/01388—495) Speed optimizations for Fermilab Multi.** Green, K.C. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1981. Contract AC06-76ER01388. 11p. (CONF-810523—14). NTIS, PC A02/MF A01. Order Number DE81028318.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

Fermilab Multi has been used at the NPL for several years now. Multi's greatest drawback - its event analysis speed is discussed. Although Multi is rated at up to 400 Hz in an RSX-11M Fortran 4-Plus environment, analysis speed drops precipitously when any real work is performed. Two major contributions to this effect have been isolated. Solutions to both are presented as well as methods for raising the 400 Hz rating to approximately 650 Hz.

32782 **(DOE/ER/01388—496) University of Washington Nuclear Physics Data Collection System.** Green, K.C. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1981. Contract AC06-76ER01388. 9p. (CONF-810523—11). NTIS, PC A02/MF A01. Order Number DE81028321.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

During the past several years, a new data collection system has been developed, replacing a previous system based on an SDS-930 computer. The system is constructed about a PDP 11/60 and an MBD-11 controlled CAMAC crate. The hardware configuration as well as a locally written singles data collection code will be described in some detail. Multiparameter data is taken with an enhanced version of Fermilab Multi. Current capabilities and future plans are discussed.

32783 **Mass archival storage: some trends, needs, and plans at DOE laboratories.** Michael, G.A. (Lawrence Livermore National Lab., CA). Contract W-7405-ENG-48. *Journal of Applied Photographic Engineering ;* 6: No. 1, 19-26(Feb 1980).

The need for mass archival storage of computer data is steadily increasing at DOE laboratories, and especially at Livermore. Computational modeling, data collection, higher computing speeds, and limits on reliability all contribute to the demand for more storage. To aid future planning, a survey of current storage capacity and projected needs for the next five years was conducted at nine DOE laboratories. The survey revealed diverse needs at different sites. The tabulated results, together with information on new hardware solicited from potential suppliers, has permitted preparation of a tentative timetable for the further development of mass archival storage at Livermore. 6 figures, 8 tables.

32784 **(ORNL/TM—7304) Sensitivity theory for nonlinear systems. I. Nonlinear functional analysis approach.** Cacuci, D.G. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE81030227.

Concepts of nonlinear functional analysis are employed to investigate the mathematical foundations underlying sensitivity theory. This makes it possible not only to ascertain the limitations inherent in existing analytical approaches to sensitivity analysis, but also to rigorously formulate a considerably more general sensitivity theory for physical problems characterized by systems of nonlinear equations and by nonlinear functionals as responses. Two alternative formalisms, labeled the Forward Sensitivity Formalism and the Adjoint Sensitivity Formalism, are developed in order to evaluate the sensitivity of the response to variations in the system parameters. The Forward Sensitivity Formalism is formulated in normed linear spaces, and the existence of the Gateaux-differentials of the operators appearing in the problem is shown to be both necessary and sufficient for its validity. Although conceptually straightforward and applicable to a considerably wider range of problems than heretofore possible, this formalism is computationally expensive to employ. The alternative Adjoint Sensitivity Formalism is considerably more economical from a computational standpoint, but, as proven here, it can only be formulated under more restrictive conditions. In particular, the requirement that operators acting on the state vector and on the system parameters must admit densely defined Gateaux-derivatives is shown to be of fundamental importance for the validity of this formalism. The present analysis significantly extends the scope of sensitivity theory and provides a basis for still further generalizations.

32785 **(ORNL/TM—7511) Sensitivity theory for nonlinear systems. II. Extensions to additional classes of responses.** Cacuci, D.G. (Oak Ridge National Lab., TN (USA)). Aug 1981. Contract W-7405-ENG-26. 37p. NTIS, PC A03/MF A01. Order Number DE81030258.

This work extends a recent, functional-analytic formulation of sensitivity theory to include treatment of additional types of responses. There are physical systems where a critical point of a function that depends on the system's state vector and parameters defines the location in phase-space where the response functional is evaluated. The Gateaux-differentials giving the sensitivities of both the functional and the critical point to changes in the system's parameters are obtained by alternative formalisms. The Forward Sensitivity Formalism is the simpler and more general, but may be prohibitively expensive for problems with large data bases. The Adjoint Sensitivity Formalism, although less generally applicable and requiring several adjoint calculations, is likely to be the only practical approach. Sensitivity theory is also extended to include treatment of general operators, acting on the system's state vector and parameters, as responses. In this case, the Forward Sensitivity Formalism is the same as for functional responses, but the Adjoint Sensitivity Formalism is considerably different. The Adjoint Sensitivity Formalism requires expanding the indirect effect term, an element of a Hilbert space, in terms of elements of an orthonormal basis. Since as many calculations of adjoint functions are required as there are non-zero terms in this expansion, careful consideration of truncating the expansion is needed to assess the advantages of the Adjoint Sensitivity Formalism over the Forward Sensitivity Formalism.

32786 **(PNL-SA—9179) Self-describing data file structure for large data sets.** Burnett, R.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 7p. (CONF-810342—3). NTIS, PC A02/MF A01. Order Number DE81027997.

From 13. symposium on the computer science and statistics interface; Pittsburgh, PA, USA (12 Mar 1981).

A major goal of the Analysis of Large Data Sets (ALDS) research project at Pacific Northwest Laboratory (PNL) is to provide efficient data organization, storage, and access capabilities for statistical applications involving large amounts of data. As part of the effort to achieve this goal, a self-describing binary (SDB) data file structure has been designed and implemented together with a set of basic data manipulation functions and supporting SDB data access routines. Logical and physical data descriptors are stored in SDB files preceding the data values. SDB files thus provide a common data representation for interfacing diverse software components. This paper describes the various types of data descriptors and data structures permitted by the file design. Data buffering, file segmentation, and a segment overflow handler are also discussed.

32787 **(PNL-SA—9370) Summary of the graphic information display session.** Carr, D.B. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 5p. (CONF-811031—1). NTIS, PC A02/MF A01. Order Number DE81028231.

From DOE statistics symposium; Berkeley, CA, USA (27 Oct 1981).

Panelists for the summary were Dan Carr, Mike Farrell and Ron Lohrding. This summary covers the workshop session and comments about the talks on Color Displays of Data - Examples, Principles and Ideas and N-Dimensional Pattern Recognition in Environmental Systems. It also includes some of the panelists' opinions and insights.

32788 **(SAND—81-0960) Specifications of Sandia prototype network communications interface between applications software and NSC A120 adapters.** Haynes, R.A.; Halbgewachs, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1981. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01. Order Number DE81028451.

The goal of the prototype network is to provide a software development tool for various network nodes of the Sandia Scientific Computer Network before they are connected to the production network. This report describes the software and function definitions that will be used in a CDC 7600 level computer for data communications interface between the prototype network input/output mechanism and the physical level of transmission.

32789 **(SAND—81-1421) Software for ordinary differential equations.** Shampine, L.F.; Watts, H.A. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 41p. NTIS, PC A03/MF A01. Order Number DE81027412.

This document discusses software issues associated with the numerical solution of ordinary differential equations. Particular methods and codes implementing the various methods have been mentioned only to illustrate specific points, e.g. the DEPAC package of ODE codes. Empahsis is placed on the concerns and decisions which are important in the design and algorithmic development of user oriented ODE software.

32790 **(SAND—81-1627) UCMD 59, 101 Programmer/User Guide. Store drawing file index information .** Young, E.G. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1981. Contract AC04-76DP00789. 22p. NTIS, PC A02/MF A01. Order Number DE81028381.

This document describes UCMD 59 - An Applicon AGS/880 User Command. It reads information from the file index table of a drawing file, stores it in a text file, and creates a formal name for the file. UCMD 101 stores the file under that name in a release area on the disc.

32791 **(SAND—81-1860C) Depth/breadth tradeoff in hierarchical computer menus.** Miller, D.P. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 13p. (CONF-811032—1). NTIS, PC A02/MF A01. Order Number DE81028392.

From Human Factors Society meeting; Rochester, NY, USA (12 Oct 1981).

Goal acquisition speed and accuracy were compared for subjects using four different menu configurations of a semantic hierarchy on an interactive computer terminal. Depth (the number of menu levels) varied from one to six, while breadth (the number of choices per menu) varied from two to 64. Goal acquisition time for the four experimental groups produced a U-shaped function with a minimum at the configuration of two levels with eight choices per level. Error data corroborated the acquisition times demonstrating that the fastest conditions also produced the least errors. Optimization of the depth/breadth tradeoff can be an important design consideration in goal acquisition tasks requiring speed and accuracy.

32792 **(SLAC-PUB—2750) FASTBUS standard: a review of the current status.** Paffrath, L. (Stanford Linear Accelerator Center, CA (USA)). May 1981. Contract AC03-76SF00515. 3p. (CONF-810523—10). NTIS, PC A02/MF A01. Order Number DE81028095.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

The new FASTBUS standard is nearing finalization, and a prototype test program has been underway for the past 18 months. This paper reviews the objectives, current status and future directions of the FASTBUS standard.

32793 **(SLAC-PUB—2753) FASTBUS status from a system designer's point of view.** Gustavson, D.B. (Stanford Linear Accelerator Center, CA (USA)). Jun 1981. Contract AC03-76SF00515. 5p. (CONF-810523—13). NTIS, PC A02/MF A01. Order Number DE81028230.

From Topical conference on computerized data acquisition in particle and nuclear physics; Oak Ridge, TN, USA (28 May 1981).

Designers of modern systems for data acquisition, control and data analysis must provide the needed thoughput, response and usability while avoiding economic and complexity limitations. Today's technology makes multiple-processor systems economically attractive, but such systems tend to be complex. In addition, rapidly changing requirements mandate easy reconfigurability and expandability. Though named for its potential speed, FASTBUS will make its greatest contribution to most systems with its flexibility and versatility. FASTBUS provides a framework in which the designer can build systems ranging from small and simple to very large and powerful in a flexible way, always leaving room for future expansion and allowing for simple tailoring of the system as needs change. This paper examines the features of FASTBUS relevant to the design of such systems, and discusses the current status. Though FASTBUS will be cost-effective even for most small systems, this paper will emphasize the large-system aspects.

32794 **(SLAC-PUB—2768) Projection pursuit methods for data analysis.** Friedman, J.H.; Stuetzle, W. (Stanford Linear Accelerator Center, CA (USA)). Jun 1981. Contract AC03-76SF00515. 24p. NTIS, PC A02/MF A01. Order Number DE81027493.

Multivariate analysis can be thought of as a methodology for detection, description and validation of structure in p-dimensional ($p > 1$) point clouds. Classical multivariate analysis relies on the assumption that the observations forming the point cloud(s) have a Gaussian distribution. All information about structure is then contained in the means and covariance matrices, and the well-known apparatus for estimation and inference in parametric families can be brought to bear. The uncomfortable ingredient in this approach is the Gaussianity assumption. The data may be Gaussian with occasional outliers or even the bulk of the data simply might not conform to a Gaussian distribution. Methods are discussed that do not involve any distributional assumptions. In this case, structure cannot be perceived by looking at a set of estimated parameters. An obvious remedy is to look at the data themselves, at the p-dimensional point cloud(s), and to base the description of structure on those views. As perception in more than three dimensions is difficult, the dimensionality of the data first has to be reduced, most simply by projection. Projection of the data generally implies loss of information. As a consequence, multivariate structure does not usually show up in all projections, and no single projection might contain all the information. It is therefore important to judiciously choose the set of projections on which the model of the structure is to be based. This is the goal of projection pursuit procedures.

32795 **(UCID—19098) Theory and implementation of the EOS fitting code RATFIT.** Fritsch, F.N. (Lawrence Livermore National Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 40p. NTIS, PC A03/MF A01. Order Number DE81029110.

This report details the theory behind the EOS fitting code RATFIT and describes how it is implemented using existing mathematical software.

32796 **(UCID—30185) Cost/benefit analysis of implementing LWG FORTRAN compiler/library systems.** Heidelberg, T. (Lawrence Livermore National Lab., CA (USA)). 6 Jul 1981. Contract W-7405-ENG-48. 45p. NTIS, PC A03/MF A01. Order Number DE81028252.

This document describes a cost/benefit analysis for implementing Language Working Group (LWG) FORTRAN through a rehostable compiler/library system at LWG laboratories. Over the past several years, under the direction of the DOE Advanced Computing Committee (ACC), the Language Working Group has prepared recommendations for extensions to standard FORTRAN which would better meet the needs of scientific computer users at the LWG laboratories. In addition the LWG has recommended that a rehostable compiler/library system be designed and implemented to support this new language, hereafter called LWG FORTRAN. At the request of the ACC, the LWG also prepared this cost/benefit analysis for the implementation effort. The major conclusion of this analysis is that implementation of LWG FORTRAN will yield significant benefits primarily through increases in programmer productivity. Benefits will exceed costs approximately eight years after the project begins. Thus, while the LWG labs have much to gain if such a system is implemented, the payoff comes much later than is usually the case in computer center projects. Six major factors are included in the analysis. The four cost factors are implementation and centralized maintenance, program conversion costs at each laboratory, programmer training costs, and local compiler maintenance costs at each laboratory. The two benefit factors are programming productivity and sharing of programs.

32797 **(USCEE—370) Terminal-state dynamic programming: quadratic costs, linear differential equations.** Collins, D.C. (University of Southern California, Los Angeles (USA)). Jul 1969. Contract AT03-76ER70019. 24p. NTIS, PC A02/MF A01. Order Number DE81029438.

9903 Information Handling

REFER ALSO TO CITATION(S) 31815, 32328, 32523, 32584, 32786

32798 (ORNL—5806, pp 45-51) **Information center complex.** Jul 1981. NTIS, PC A04/MF A01.

In Overview of the biomedical and environmental programs at the Oak Ridge National Laboratory.

The Information Center Complex (ICC), a constituent of the Information Division of ORNL, provides information support services ranging from query responses to abstracted and keyworded bibliographies. ICC's programs are focused on three major areas: environmental and health effects of toxic and hazardous substances; energy resources, production and utilization; and waste disposal. The recent major accomplishments of the ICC are listed and the nine major units of the ICC are discussed. (KRM)

32799 **(PB—81-122988) The energy link catalog. Volume 1: guide to federal energy research.** Stiko, P.T. (National Science Foundation, Washington, DC (USA)). 1 Feb 1980. 57p. NTIS, PC A04/MF A01.

The Energy Link Project, through the development of a simplified resource/technology locator system, has improved the accessibility and usability of a vast storehouse of available resources from the Federal Laboratory System in the energy field. This locator system was designed from the point of view of local government management. This orientation allows the user to identify his needs and then pull the available resources applicable to alternative solutions from the Federal Laboratory System. The cooperative approach utilized between the Federal Laboratory Consortium for Technology Transfer (FLC) representing the technology source and the Science Technology Application Center (SANDTAC) representing the local government user has resulted in a system that is compatible and usable within both institutional areas.

32800 **(PNL-SA—9219) Data editing on large data sets.** Thomas, J.J.; Burnett, R.A.; Lewis, J.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 11p. (CONF-810342—2). NTIS, PC A02/MF A01. Order Number DE81028022.

From 13. symposium on the computer science and statistics interface; Pittsburgh, PA, USA (12 Mar 1981).

The process of analyzing large data sets often includes an early exploratory stage to first, develop a basic understanding of the data and its interrelationships and second, to prepare and cleanup the data for hypothesis formulation and testing. This preliminary phase of the data analysis process usually requires facilities found in research data management systems, text editors, graphics packages, and statistics packages. Also this process usually requires the analyst to write special programs to cleanup and prepare the data for analysis. This paper describes a technique now implemented as a single computational tool, a data editor, which combines a cross section of facilities from the above systems with emphasis on research data base manipulation and subsetting techniques. The data editor provides an interactive environment to explore and manipulate data sets with particular attention to the implications of large data sets. It utilizes a relational data model and a self describing binary data format which allows data transportability to other data analysis packages. Some impacts of editing large data sets will be discussed. A technique for manipulating portions or subsets of large data sets without physical replication is introduced. Also an experimental command structure and operating environment are presented.

9904 Law

32801 **(LA-UR—81-2369) Discovery by the examiner.** Walterscheid, E.C. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 24p. (CONF-810936—1). NTIS, PC A02/MF A01. Order Number DE81028733.

From 5. annual patent conference of the Bureau of National Affairs, Inc.; Arlington, VA, USA (9 Sep 1981).

The Manual of Patent Examining Procedure (M.P.E.P.), 4th Edition now has a chapter 2100 on patentability. At present this chapter only contains sections dealing with Patentable Subject Matter - Microorganisms and the Statutory Bars of Public Use and On Sale (35 U.S.C. 102(b), but it is the intent of the Patent and Trademark Office to expand its content as future revisions of the M.P.E.P. are issued. The requirement for information provisions of chapter 2100 - if they are upheld on judicial review - portend a significant change in the relationship of the examiner and the applicant in ex parte prosecution. In view of the fact that the Office positions which appear to herald this change have been adopted without public review or comment, it is imperative that members of the patent bar review them critically and express their concerns to the Office. Simply put, although the M.P.E.P. carefully avoids any use of the term, the Office in chapter 2100 is indicating that an examiner has a right of discovery in ex parte prosecution. Accordingly, the purpose of this article is to discuss the extent to which the Office is attempting to sanction discovery by examiners. In particular, it will explore certain of the ramifications of the requirement for information provisions of chapter 2100. It will begin by outlining the requirements for information in ex parte prosecution which are expressly permitted by the rules of practice. It will then review the authority for discovery requirements in ex parte prosecution and consider the sanction for failure to meet such a requirement. Some consideration will then be given to the extent and effect of a requirement for information presented under the aegis of chapter 2100. The potential for Office discovery in the prosecution of reissue applications will be briefly examined. Finally, the failure of the Office to seek public review or comment in presenting the requirement for information provisions of chapter 2100 will be briefly discussed.

9905 Civilian Defense

32802 **(AD-A—089212) Models of shelter management training and delivery systems. Final report, 2 April 1979-May 1980.** Thomas, J.W.; Studebaker, D.P.; Hecht, J.C.; Banathy, B.H. (Far West Lab. for Educational Research and Development, San Francisco, CA (USA)). 31 May 1980. Contract DCPA01-79-C-0248. 232p. NTIS, PC A11/MF A01.

The report presents two models: a model of a shelter management training system and a model of a delivery system for that training system. The project was to design procedures and arrangements that would provide for the training of 30,000 managers of congregate care facilities and fallout shelters during various time periods including peacetime. The report presents a number of related analyses intended as input to model building efforts. For the training model, audience characteristics, the shelter environment, areas of responsibility, and instructional management considerations are examined and converted into a set of considerations and options. Three training configurations are then developed based on three training scenarios. For the design of the delivery system, prerequisites and requirements are described and delivery components are defined. The viability of two candidate delivery agencies is then assessed with reference to system requirements and a number of organizational dimensions. Finally, optimal delivery strategies are described based on a combination of the capabilities of the two agencies.

CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Academy of Natural Sciences, Avondale, PA (USA). Stroud Water Research Center
Geographic analysis of thermal equilibria: a bioenergetic model for predicting thermal response of aquatic-insect communities. Technical progress report, July 1, 1980-December 31, 1981 and proposed research program, January 1, 1982-June 30, 1983, 6:32555 (DOE/EV/10259—2)

Ackenheil and Associates Geo Systems, Inc., Pittsburgh, PA (USA)
Phase I: the pipeline gas demonstration plant. Foundation investigation and soil analyses report, 6:31558 (DOE/ET/13060—T5)

Acres American, Inc., Columbia, MD
Preliminary design study of underground pumped hydro and compressed-air energy storage in hard rock. Volume 3. Project design criteria: CAES. Final report, 6:32079 (EPRI-EM—1589-Vol.3)

Aerojet Energy Conversion Co., Sacramento, CA (USA)
Combustion enhancement and pollutant control research with acoustically induced mixing. Technical progress report, March-June, 1981, 6:31615 (DOE/PC/40270—1)
Multi-use geothermal-energy system with augmentation for enhanced utilization: a non-electric application of geothermal energy in Susanville, California. Final report, 6:31915 (DOE/ET/28447—T1)

Aeropower, Berkeley, CA (USA)
Wind energy education projects. Final report, 6:31921 (DOE/SF/01959—T1)

Aerospace Corp., El Segundo, CA (USA). Energy and Transportation Div.
Highlights of the solar total energy technology symposium, 6:31841 (ATR—75(7523-02)-2)

Aerospace Corp., Germantown, MD (USA)
Military wastes-to-energy applications. Final report for FY 1979-80, 6:32191 (PB—81-132227)

Agri Stills of America, Springfield, IL
Development of a small-scale commercial alcohol dehydration 190 to 200 proof. Final report, 6:31786 (DOE/AF/92005—T1)

AiResearch Mfg. Co., Phoenix, AZ (USA)
Compound cycle turbofan engine (CCTE). Task IX. Carbon-slurry fuel combustion evaluation program. Final report June-September 1979, 6:32204 (AD-A—089451)
Final technical study on reduction of automotive accessory power requirements. Final report, June 1974-June 1978, 6:32216 (DOE/CS/51095—T4)

AiResearch Mfg. Co., Torrance, CA (USA)
Advanced electric propulsion system concept for electric vehicles. Addendum 1. Voltage considerations, 6:32210 (DOE/NASA/0081—2)

Air Force Geophysics Lab., Hanscom AFB, MA (USA)
Statistical methods for solar flare probability forecasting. Final report Jun 79-Feb 80, 6:32603 (AD-A—092708)

Allied-General Nuclear Services, Barnwell, SC (USA)
AFR spent-fuel-storage program. Technical progress report, April 1981-June 1981, 6:31691 (AGNS—47921-TPR-17)
Demonstrate fuel disassembly/encapsulation. Technical progress report, April 1981-June 1981, 6:31690 (AGNS—47921-3026-TPR-18)
Integrated near real-time plutonium inventory system for LWR reprocessing solutions, 6:31760 (AGNS—35900-Conf-137)

AMC Cancer Research Center and Hospital, Lakewood, CO (USA)
Technical progress report, April 1, 1979-July 31, 1981, 6:32554 (DOE/EV/10100—T1)

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York
Bibliography on available computer programs in the general area of heating, refrigerating, air conditioning, and ventilating, 6:32157 (DOE/CE/20057—1)

Ames Lab., IA (USA)
Ames Laboratory research report, 1980, 6:32110 (IS—4767)
Application of inductively coupled plasma-atomic emission and fluorescence spectroscopy to the safeguarding of a nuclear facility, 6:31763 (IS-M—336)
Characterization and environmental studies of Pompano Beach anaerobic digestion facility. Semi-annual report, 6:32410 (DOE/EV/10133—2)

AnaChem, Inc., Albuquerque, NM (USA)
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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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	6:32601	SAND—81-0938
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	6:32759	SAND—81-0622
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AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
	6:31712	RFP—3132
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	6:32378	RFP—3058
AC04-77DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	6:32761	SAND—81-0842C
AC05-76ET53036	**Texas Univ., Austin (USA). Fusion Research Center**	
	6:32711	DOE/ET/53036—27
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	6:32713	DOE/ET/53036—30
AC05-76OR00033	**Oak Ridge Associated Universities, Inc., TN (USA)**	
	6:31826	ORAU—181A
	6:31827	ORAU—182
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AC05-76RL01830	**Battelle Pacific Northwest Labs., Richland, WA (USA)**	
	6:32460	PNL-SA—9584

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AC06-76ER01388	**Washington Univ., Seattle (USA). Nuclear Physics Lab.**	
	6:32780	DOE/ER/01388—494
	6:32781	DOE/ER/01388—495
	6:32782	DOE/ER/01388—496
AC06-76RL01830	**Battelle Pacific Northwest Labs., Richland, WA (USA)**	
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	6:31767	PNL—3725
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	6:31898	PNL—2991
	6:31899	PNL—3847
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	6:32073	PNL-SA—9328
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	6:32256	PNL-SA—9285
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	6:32269	PNL—3913
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	6:32446	PNL-SA—9122
	6:32447	PNL-SA—9123
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AC06-76RLO1830	**Battelle Pacific Northwest Labs., Richland, WA (USA)**	
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AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Energy Systems Group**	
	6:31714	RHO-SA—203
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
	6:31658	EGG-FM—5517
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	6:31897	EGG—2119
	6:32051	GEND—008
	6:32057	EGG-PHYS—5500
	6:32671	EGG-PHYS—5182
AC07-79ID01675	**Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)**	
	6:31703	ENICO—1085
AC08-76NV00410	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)**	
	6:32444	DOE/NV/00410—64
	6:32593	DOE/NV/00410—21-Rev.7
AC08-76NV01183	**EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group**	
	6:32445	EGG—1183-1756-Rev.1
AC08-79BC10005	**CK GeoEnergy Corp., Las Vegas, NV (USA)**	
	6:31645	DOE/BC/10005—5
AC08-79DP40086	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Fusion Power Systems Dept.**	
	6:32767	WFPS-TME—81-011
AC08-79DP40107	**Western Research Corp., San Diego, CA (USA)**	
	6:32739	DOE/DP/40107—1
AC08-79DP40113	**Avco-Everett Research Lab., Everett, MA (USA)**	
	6:32344	DOE/DP/40113—1
AC08-79ET27111	**Trinity Univ., San Antonio, TX (USA)**	
	6:31886	CONF-811021—1
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AC08-80ET27081	**Eaton Operating Co., Inc., Houston, TX (USA)**	
	6:31649	DOE/ET/27081—6
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AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	6:31672	GJBX—283-81
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	6:31702	DPST—80-249
	6:32434	DP-MS—81-20
AC09-78ET35900	**Allied-General Nuclear Services, Barnwell, SC (USA)**	
	6:31760	AGNS—35900-Conf-137
AC09-79ET41900	**Rockwell International Corp., Richland, WA (USA). Energy Systems Group**	
	6:31701	DOE/ET/41900—6
AC09-79ET47921	**Allied-General Nuclear Services, Barnwell, SC (USA)**	
	6:31690	AGNS—47921-3026-TPR-18
	6:31691	AGNS—47921-TPR-17
AC09-79ET47923	**Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div.**	
	6:31692	BAW—1645-1
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AC12-76SN00052	**Knolls Atomic Power Lab., Schenectady, NY (USA)**	
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	6:32350	KAPL—4129
AC13-76GJ01664	**Arizona Univ., Tucson (USA). Dept. of Mining and Geological Engineering**	
	6:31664	GJBX—269-81
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AC14-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
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	6:32747	HEDL-SA—2401-FP
AC15-76CL02395	**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**	
	6:32242	CONF-811003—2
AC15-76CL50003	**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**	
	6:32007	CRBRP-GEFR-SP—241
AC19-79BC10053	**Market Facts, Inc., Chicago, IL (USA)**	
	6:31636	DOE/BC/10053—21
AC19-80BC10255	**University of Central Florida, Orlando (USA). Coll. of Engineering**	
	6:31620	DOE/BC/10255—4
AC21-77ET10296	**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**	
	6:31533	DOE/ET/10296—T2
AC21-77ET10373	**Combustion Power Co., Inc., Menlo Park, CA (USA)**	
	6:31943	DOE/ET/10373—T8

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AC21-80ET15460	**Wormser Engineering, inc., Middleton, MA (USA)**	
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AC22-77ET10482	**Pennsylvania State Univ., University Park (USA). Dept. of Chemistry**	
	6:31561	DOE/ET/10482—T2
AC22-78ET11053	**TRW Defense and Space Systems Group, Redondo Beach, CA (USA)**	
	6:32137	DOE/ET/11053—T1
AC22-79ET14879	**State Univ. of New York, Binghamton (USA). Dept. of Chemistry**	
	6:31536	DOE/ET/14879—T6
AC22-79ET14941	**Battelle Columbus Labs., OH (USA)**	
	6:31559	BMI—2086
AC22-80PC30291	**Avco-Everett Research Lab., Inc., Everett, MA (USA)**	
	6:31540	DOE/PC/30291—3
AC22-80PC30292	**Physical Sciences, Inc., Woburn, MA (USA)**	
	6:32327	DOE/PC/30292—3
AC22-81PC40270	**Aerojet Energy Conversion Co., Sacramento, CA (USA)**	
	6:31615	DOE/PC/40270—1
AC22-81PC41035	**New Hampshire Univ., Durham (USA)**	
	6:31542	DOE/PC/41035—1
AC51-79ET27229	**Northwest Geothermal Corp., Portland, OR (USA)**	
	6:31914	DOE/ET/27229—T1
AI01-76CS31037	**Wyle Labs., Huntsville, AL (USA). Solar Energy Systems Div.**	
	6:31877	DOE/NASA/CR—161825
AI01-77CS51040	**IIT Research Inst., Chicago, IL (USA)**	
	6:32208	DOE/NASA/9696—1
	6:32209	DOE/NASA/0032—12
AI01-77CS51044	**National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center**	
	6:32090	DOE/NASA/51044—16
	6:32210	DOE/NASA/0081—2
	6:32212	DOE/NASA/0123—2
	6:32213	DOE/NASA/0189—81/1
AI01-80ET17088	**Energy Research Corp., Danbury, CT (USA)**	
	6:32149	DOE/NASA/0201—3
AI03-76ET33003	**Jet Propulsion Lab., Pasadena, CA (USA)**	
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AI04-80AL12726	**National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center**	
	6:32150	DOE/NASA/12726—9
AI05-80OR20679	**National Bureau of Standards, Washington, DC (USA). Center for Materials Science**	
	6:32268	DOE/OR/20679—T5
AI08-76DP00539	**Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring and Support Lab.**	
	6:32432	DOE/DP/00539—044
AI08-78ET44802	**Geological Survey, Denver, CO (USA)**	
	6:32596	DOE/ET/44802—T2
AM01-76EI02295	**Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.**	
	6:31782	MIT-EL—81-005
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AM03-76SF00167	**General Atomic Co., San Diego, CA (USA)**	
	6:31997	GA-D—13393(Rev.1)
AS02-76DP40071	**Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemistry**	
	6:32343	DOE/DP/40071—T1
AS02-76ER01367	**Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering**	
	6:32246	DOE/ER/01367—T1
AS02-76ER01426	**Colorado Univ., Boulder (USA). Dept. of Chemistry**	
	6:32489	DOE/ER/01426—T1
AS02-76ER01713	**Washington Univ., St. Louis, MO (USA). Dept. of Chemistry**	
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AS02-76ER02009	**Indiana Univ., Bloomington (USA). Dept. of Physics**	
	6:32632	DOE/ER/02009—T1
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AS02-76ER02192	**Wayne State Univ., Detroit, MI (USA). Dept. of Chemistry**	
	6:32314	DOE/ER/02192—1
AS02-76ER02422	**Rochester Univ., NY (USA). Dept. of Mechanical Engineering**	
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AS02-76ER02490	**Ohio Univ., Athens (USA)**	
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AS02-76ER02534	**Massachusetts Inst. of Tech., Cambridge (USA)**	
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AS02-76ER02837	**Kansas Univ., Lawrence (USA). Dept. of Chemistry**	
	6:32478	DOE/ER/03827—6
AS02-76ER02995	**Arizona State Univ., Tempe (USA). Dept. of Physics**	
	6:32267	DOE/ER/02995—5
AS02-76ER03117	**Brandeis Univ., Waltham, MA (USA)**	
	6:32320	DOE/ER/03117—T1
AS02-76ER03162	**Cornell Univ., Ithaca, NY (USA)**	
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AS02-76ER03244	**Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Physics**	
	6:32617	DOE/ER/03244—T3
AS02-76ER03496	**Rochester Univ., NY (USA). Dept. of Chemistry and Physics**	
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AS02-76ER03539	**Temple Univ., Philadelphia, PA (USA). Dept. of Physics**	
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AS02-76ER13001	**State Univ. of New York, Stony Brook (USA)**	
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AS02-76ET37227	**Wisconsin Univ., Milwaukee (USA). Coll. of Engineering and Applied Science**	
	6:32064	DOE/ET/37227—T3
AS02-76ET37241	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering**	
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AS02-76ET53032	**Rochester Univ., NY (USA). Dept. of Mechanical Engineering**	
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AS02-76ET53051	**Wisconsin Univ., Madison (USA)**	
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AS02-76EV01340	**Colorado State Univ., Fort Collins (USA). Dept. of Atmospheric Science**	
	6:32405	DOE/EV/01340—1
AS02-76EV01671	**Nebraska Univ., Lincoln (USA). Dept. of Physics**	
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AS02-76EV02364	**Oakland Univ., Rochester, MI (USA)**	
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AS02-76EV02874	**Columbia Univ., New York (USA). School of Public Health**	
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AS02-76EV04114	**Massachusetts Inst. of Tech., Cambridge (USA)**	
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AS02-77EV04477	**Wyoming Univ., Laramie (USA). Dept. of Zoology and Physiology**	
	6:32553	DOE/EV/04477—2

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AS02-78CS40059	**Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Agricultural Engineering**	
	6:32184	DOE/CS/40059—T1
AS02-78ER04694	**Rochester Univ., NY (USA)**	
	6:32618	DOE/ER/04694—T1
AS02-78ET53076	**Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center**	
	6:32703	CONF-800932—9
AS02-78EV04960	**Colorado State Univ., Fort Collins (USA). Dept. of Chemistry**	
	6:31661	DOE/ER/04960—2
AS02-79ER10451	**Michigan Univ., Ann Arbor (USA)**	
	6:32376	DOE/ER/10451—2
AS02-80CS30259	**Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.**	
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AS05-76ER03106	**Florida Univ., Gainesville (USA). Dept. of Chemistry**	
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AS05-76ER03992	**Texas Univ., Austin (USA). Dept. of Physics**	
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AS05-76ER05126	**Maryland Univ., College Park (USA). Dept. of Physics and Astronomy**	
	6:32648	CONF-810747—3
AS05-76ET28465	**Louisiana State Univ., Baton Rouge (USA). Dept. of Petroleum Engineering**	
	6:31885	DOE/ET/28465—T1
AS05-76ET53045	**College of William and Mary, Williamsburg, VA (USA)**	
	6:32716	DOE/ET/53045—T1
AS05-76EV03944	**Miami Univ., FL (USA). Rosenstiel School of Marine and Atmospheric Sciences**	
	6:32433	DOE/EV/03944—18
AS05-77ET53042	**Texas Univ., Austin (USA)**	
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AS05-78EV05854	**Florida State Univ., Tallahassee (USA)**	
	6:32492	DOE/EV/05854—T1
AS05-78EV06047	**Florida Univ., Gainesville (USA). Center for Wetlands**	
	6:32437	DOE/EV/06047—1
AS05-78EV10133	**Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering**	
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AS05-78OR06074	**Gilbert/Commonwealth, Reading, PA (USA)**	
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AS05-79CS40212	**North Carolina State Univ., Raleigh (USA). School of Textiles**	
	6:32185	DOE/CS/40212—T1
AS05-79ET15415	**Montana State Univ., Bozeman (USA). Dept. of Physics**	
	6:32148	DOE/ET/15415—1
AS05-80ER10698	**North Carolina State Univ., Raleigh (USA)**	
	6:32740	DOE/ER/10698—1
AS05-80ER10742	**North Carolina State Univ., Raleigh (USA). Dept. of Physics**	
	6:32374	DOE/ER/10742—1
AS05-80EV10404	**Texas A and M Univ., College Station (USA). Dept. of Chemistry**	
	6:32411	DOE/EV/10404—1
AS06-78OR06074	**Gilbert/Commonwealth, Reading, PA (USA)**	
	6:32018	DOE/OR/06074—1-Vol.6
AS22-78PC04717	**Texas A and M Univ., College Station (USA). Dept. of Chemical Engineering**	
	6:31781	DOE/PC/04717—6
AT01-77CS51044	**National Aeronautics and Space Administration, Washington, DC (USA)**	
	6:32211	DOE/NASA/0123—1
AT01-77ET10694	**National Bureau of Standards, Washington, DC (USA). Center for Materials Science**	
	6:31547	NBSIR—81-2191(DOE)
AT02-79ET34223	**General Electric Co., San Jose, CA (USA). Nuclear Energy Div.**	
	6:32023	GEAP—25332-2
AT03-76ER70019	**University of Southern California, Los Angeles (USA)**	
	6:32797	USCEE—370
AT03-76ER70172	**California Univ., Los Angeles (USA). School of Engineering and Applied Science**	
	6:32689	UCLA-ENG—7399
AT03-76ET20605	**SRI International, Menlo Park, CA (USA)**	
	6:31815	DOE/ET/20605—T2
AT03-76ET35301	**General Atomic Co., San Diego, CA (USA)**	
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AT03-76ET51011	**General Atomic Co., San Diego, CA (USA)**	
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AT03-76EV70037	**Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group**	
	6:31685	DOE/EV/70037—T4
AT03-76SF70010	**General Electric Co., Sunnyvale, CA (USA)**	
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AT03-76SF70097	**SRI International, Menlo Park, CA (USA)**	
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AT03-76SF71023	**General Atomic Co., San Diego, CA (USA)**	
	6:32010	DOE/SF/71023—T4
AT03-76SF71031	**General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.**	
	6:31683	DOE/SF/71031—T4
AT03-76SF71032	**General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.**	
	6:32042	CONF-771237—2
AT03-76SF71053	**General Atomic Co., San Diego, CA (USA)**	
	6:31687	GA-A—16405
AT03-76SF91101	**Aerospace Corp., El Segundo, CA (USA). Energy and Transportation Div.**	
	6:31841	ATR—75(7523-02)-2
AT03-76SF98001	**General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.**	
	6:32011	DOE/SF/98001—T10
AT03-80SF11512	**General Atomic Co., San Diego, CA (USA)**	
	6:32248	GA-A—16144
FC02-79CS30278	**Florida Solar Energy Center, Cape Canaveral (USA)**	
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FC03-78ET20074	**BioEnergy Development Corp., Hilo, HI (USA)**	
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FC20-78LC10747	**Equity Oil Co., Salt Lake City, UT (USA)**	
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FC20-78LC10787	**Geokinetics, Inc., Concord, CA (USA)**	
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FG01-79CS20170	**New York City Dept. of Sanitation (USA)**	
	6:32198	DOE/CS/20170—1
FG01-79CS60473	**National Conference of State Legislatures, Washington, DC (USA). Special Task Force on Energy**	
	6:32113	DOE/CS/60473—T1
FG01-80CS10328	**California Public Utilities Commission, San Francisco (USA)**	
	6:32197	DOE/CE/10328—1
FG01-80RA50146	**Northern Indiana Public Service Co., Hammond (USA)**	
	6:31543	DOE/RA/50146—1
FG02-80R510248	**Cumberland Development Corp., WI (USA)**	
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FG02-81AF92005	**Agri Stills of America, Springfield, IL**	
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FG02-81AF92016	**Gabrielson (James E.), Plymouth, MN (USA)**	
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FG02-81ER10868	**Arizona Univ., Tucson (USA)**	
	6:32382	CONF-810316—
FG03-78SF01959	**Aeropower, Berkeley, CA (USA)**	
	6:31921	DOE/SF/01959—T1
FG03-78SF02013	**Aeropower, Berkeley, CA (USA)**	
	6:31921	DOE/SF/01959—T1
FG03-79SF10754	**Harvey Mudd Coll., Claremont, CA (USA)**	
	6:32065	DOE/SF/10754—T2
FG05-79ET60058	**Atlanta Univ., GA (USA). Dept. of Chemistry**	
	6:31818	DOE/ET/60058—T1
FG05-80ET53088	**Texas Univ., Austin (USA). Inst. for Fusion Studies**	
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	6:32580	*See* EPA/600/9-81-001
	6:32581	*See* EPA/600/9-81-001
	6:32582	*See* EPA/600/9-81-001
CONF-800235-		(ASM/SAMPE conference on specialized cleaning, finishing and coating processes, Los Angeles, CA, USA, 5-6 Feb 1980)
	6:31881	Metals Park, OH; American Society for Metals (1981).
CONF-800371-		(5. international technical conference of slurry transportation, Lake Tahoe, NV, USA, 26-28 Mar 1980)
	6:31587	Washington, DC; Slurry Transport Association (1980).
CONF-8003140-		(2. annual energy seminar, Erie, PA, USA, 31 Mar-1 Apr 1980)
	6:32153	$7.00

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CONF-800696-		(International conference on dislocation modeling of physical systems, Gainesville, FL, USA, 22-27 Jun 1980)
3	6:32252	*See* LBL-11628
CONF-8006181-		(Intermediate-energy nuclear chemistry workshop, Los Alamos, NM, USA, 23-27 Jun 1980)
	6:32367	*See* LA-8835C
	6:32619	*See* LA-8835C
	6:32620	*See* LA-8835C
	6:32621	*See* LA-8835C
	6:32638	*See* LA-8835C
	6:32639	*See* LA-8835C
	6:32640	*See* LA-8835C
	6:32641	*See* LA-8835C
	6:32642	*See* LA-8835C
	6:32643	*See* LA-8835C
	6:32644	*See* LA-8835C
	6:32645	*See* LA-8835C
	6:32646	*See* LA-8835C
	6:32660	*See* LA-8835C
	6:32662	*See* LA-8835C
	6:32672	*See* LA-8835C
	6:32685	*See* LA-8835C
	6:32686	*See* LA-8835C
CONF-8006185-		(Canadian national power alcohol conference, Manitoba, Canada, 20 Jun 1980)
1	6:32206	NTIS, PC A02/MF A01. Order Number DE81025834, Distribution Category MN -96
CONF-800820-		(American Statistical Society meeting, Houston, TX, USA, 11-14 Aug 1980)
13	6:32775	NTIS, PC A02/MF A01. Order Number DE81028531, Distribution Category MN -13
CONF-8008120-		(7. international conference on atomic physics, Cambridge, MA, USA, 4-8 Aug 1980)
1	6:32615	NTIS, PC A03/MF A01. Order Number DE81025467, Distribution Category MN -34A
CONF-8008122-		(Workshop on U-bend tube cracking in steam generators, Denver, CO, USA, 20-21 Aug 1980)
	6:31964	*See* EPRI-WS-80-136
CONF-800932-		(2. joint Grenoble-Varenna international symposium on heating in toroidal plasmas, Como, Italy, 3-12 Sep 1980)
9	6:32703	NTIS, PC A02/MF A01. Order Number DE81028193, Distribution Category MN -20e
CONF-8009163-		(Workshop on corrosion of inconel 600 steam generator tubing in the tubesheet crevice, Palo Alto, CA, USA, 9-10 Sep 1980)
	6:31927	*See* EPRI-WS-80-157
	6:31965	*See* EPRI-WS-80-157
	6:31966	*See* EPRI-WS-80-157
	6:31967	*See* EPRI-WS-80-157
	6:31968	*See* EPRI-WS-80-157
	6:31969	*See* EPRI-WS-80-157
	6:31970	*See* EPRI-WS-80-157
	6:31971	*See* EPRI-WS-80-157
	6:31972	*See* EPRI-WS-80-157
	6:31973	*See* EPRI-WS-80-157
	6:31974	*See* EPRI-WS-80-157
	6:31975	*See* EPRI-WS-80-157
	6:31976	*See* EPRI-WS-80-157
	6:31977	*See* EPRI-WS-80-157
	6:31978	*See* EPRI-WS-80-157
	6:31979	*See* EPRI-WS-80-157
CONF-8010129-		(Solar central receiver semi-annual meeting, San Francisco, CA, USA, 15 Oct 1980)
	6:31846	*See* SAND-80-8049
CONF-8010154-		(Workshop on Future Relativistic Heavy Ion Experiments, Darmstadt, F.R. Germany, 7-10 Oct 1980)
4	6:32682	NTIS, PC A04/MF A01. Order Number DE81023847, Distribution Category MN -34C
CONF-801104-		(73. annual meeting of the American Institute of Chemical Engineers, Chicago, IL, USA, 12-16 Nov 1980)
	6:31545	AIChE Symp. Ser., 77: 1-10(1981)
CONF-801124-		(3. annual meeting of the Materials Research Society, Boston, MA, USA, 17-20 Nov 1980)
53	6:31704	*See* LBL-11143
CONF-801126-		(ORSA/TIMS joint national meeting, Colorado Springs, CO, USA, 9-12 Nov 1980)
3	6:32108	*See* BNL-29751

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CONF-801143-		(Industrial hygiene and occupational medicine in coal conversion projects workshop, Washington, DC, USA, 7 Nov 1980)
2	6:31548	*See* PNL-SA-9516
CONF-801250-		(10. Texas symposium on relativistic astrophysics, Baltimore, MD, USA, 15-19 Dec 1980)
2	6:32696	*See* DOE/ER/03992-440
CONF-810103-		(Measurement science conference, Anaheim, CA, USA, 30-31 Jan 1981)
3	6:32692	*See* PNL-SA-9088
CONF-810125-		(Solar technology assessment conference, Orlando, FL, USA, 29-30 Jan 1981)
1	6:31805	NTIS, PC A03/MF A01. Order Number DE81029089, Distribution Category MN -59
CONF-810152-		(Informal workshop on the penetration of exotic particles in matter, New York, NY, USA, 8-11 Jan 1981)
1	6:32614	*See* BNL-29448
CONF-810214-		(4. topical conference on radio frequency plasma heating, Austin, TX, USA, 9-10 Feb 1981)
7	6:32705	*See* DOE/ET/51013-7
8	6:32708	*See* DOE/ET/51013-10
9	6:32709	*See* DOE/ET/51013-11
CONF-810217-		(ANS waste management conference, Tucson, AZ, USA, 23-26 Feb 1981)
19	6:31758	*See* PNL-SA-8881
CONF-810259-		(6. annual NEA-seabed working group meeting, Paris, France, 2-5 Feb 1981)
	6:31717	*See* SAND-81-0427
	6:31718	*See* SAND-81-0427
	6:31719	*See* SAND-81-0427
	6:31720	*See* SAND-81-0427
	6:31721	*See* SAND-81-0427
	6:31722	*See* SAND-81-0427
	6:32539	*See* SAND-81-0427
CONF-810316-		(High temperature electronics conference, Tucson, AZ, USA, 25-27 Mar 1981)
	6:32005	NTIS, PC A07/MF A01
	6:32224	NTIS, PC A07/MF A01
	6:32380	NTIS, PC A07/MF A01
	6:32382	NTIS, PC A07/MF A01. Order Number DE81025058, Distribution Category MN -37
	6:32383	NTIS, PC A07/MF A01
	6:32384	NTIS, PC A07/MF A01
	6:32385	NTIS, PC A07/MF A01
	6:32392	NTIS, PC A07/MF A01
CONF-810342-		(13. symposium on the computer science and statistics interface, Pittsburgh, PA, USA, 12-13 Mar 1981)
2	6:32800	*See* PNL-SA-9219
3	6:32786	*See* PNL-SA-9179
CONF-810360-		(12. biomass thermochemical conversion contractors meeting, Washington, DC, USA, 18-19 Mar 1981)
4	6:31785	*See* PNL-SA-9350
CONF-810368-		(Conference on perturbative quantum chromodynamics, Tallahassee, FL, USA, 25-28 Mar 1981)
4	6:32654	*See* SLAC-PUB-2762
CONF-810372-		(Symposium on uncertainties associated with the regulation of the geologic disposal of high-level radioactive waste, Gatlinburg, TN, USA, 9-15 Mar 1981)
11	6:31711	*See* PNL-SA-9111
12	6:31710	*See* PNL-SA-9094
CONF-810389-		(14. IAEA annual meeting, Vienna, Austria, 31 Mar-3 Apr 1981)
(Summ.) (Pt.2)	6:32013	*See* IWGFR-37/2
CONF-810390-		(Europhysics study conference on partons in soft-hadronic processes, Erice, Italy, 8-14 Mar 1981)
1	6:32651	*See* DOE/ER/03992-439
CONF-810392-		(Seminar on high energy ion-atom collision processes, Debrecen, Hungary, 17-19 Mar 1981)
1	6:32625	*See* PNL-SA-9306
CONF-810405-		(3. annual systems simulation, economic analysis/ solar heating and cooling operational results conference, Reno, NV, USA, 27 Apr-1 May 1981)
16	6:31856	*See* LBL-11390
CONF-810423-		(1. International Energy Agency (IEA) conference on new energy conservation technologies and their commercialization, Berlin, F.R. Germany, 6-10 Apr 1981)
7	6:32161	*See* LBL-12300

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CONF-810470-		(13. symposium on nondestructive evaluation, San Antonio, TX, USA, 21 Apr 1981)
2	6:32351	*See* PNL-SA-9499
CONF-810488-		(International symposium on energy and ecological modelling, Louisville, KY, USA, 20-24 Apr 1981)
2	6:32592	*See* PNL-SA-9098
CONF-8104104-		(SPIE technical symposium, Washington, DC, USA, 20-24 Apr 1981)
1	6:32408	*See* BNL-29792
CONF-8104105-		(Nuclear waste seminar, Baton Rouge, LA, USA, 7 Apr 1981)
1	6:31762	*See* DOE/TIC-11467
CONF-810523-		(Topical conference on computerized data acquisition in particle and nuclear physics, Oak Ridge, TN, USA, 28-30 May 1981)
10	6:32792	*See* SLAC-PUB-2750
11	6:32782	*See* DOE/ER/01388-496
12	6:32780	*See* DOE/ER/01388-494
13	6:32793	*See* SLAC-PUB-2753
14	6:32781	*See* DOE/ER/01388-495
15	6:32370	*See* SLAC-PUB-2742
CONF-810526-		(15. IEEE PV specialists conference, Orlando, FL, USA, 11-15 May 1981)
39	6:31836	*See* DOE/ET/20279-147
CONF-810545-		(3. conference on waste heat management and utilization, Miami, FL, USA, 12 May 1981)
5	6:32467	*See* PNL-SA-9292
6	6:32112	*See* PNL-SA-9164
CONF-810579-		(2. workshop on EBIS and related topics, Saclay, France, 12-15 May 1981)
2	6:32368	*See* LBL-12685
3	6:32622	*See* LBL-12686
CONF-810584-		(NATO advanced study institute on atomistics of France, Corsica, France, 22-31 May 1981)
2	6:32258	*See* PNL-SA-9546
CONF-810588-		(DOE/NBS workshop on environmental speciation and monitoring needs, Gaithersburg, MD, USA, 18-20 May 1981)
4	6:32460	*See* PNL-SA-9584
CONF-8105104-		(5. high energy heavy ion study, Berkeley, CA, USA, 18-22 May 1981)
2	6:32666	*See* LBL-12978
5	6:32668	*See* LBL-12641
6	6:32653	*See* LBL-12872
7	6:32665	*See* LBL-12623
CONF-8105105-		(Symposium on electrocatalyis, Minneapolis, MN, USA, 10-15 May 1981)
4	6:32308	*See* LBL-11891
CONF-810602-		(7. symposium on detonation, Annapolis, MD, USA, 19 Jun 1981)
32	6:32396	*See* SAND-81-1773C
CONF-810606-		(American Nuclear Society's annual meeting, Miami Beach, FL, USA, 7-12 Jun 1981)
87	6:32746	*See* HEDL-SA-2311-FP
89	6:32012	*See* HEDL-SA-2344
91	6:32058	*See* HEDL-SA-2319-S
92	6:32059	*See* HEDL-SA-2412-FP
93	6:31688	*See* HEDL-SA-2327
CONF-810607-		(Symposium on instrumentation and control for fossil energy processes, San Francisco, CA, USA, 8-12 Jun 1981)
13	6:32626	*See* SAND-81-8608
CONF-810620-		(4. international topical conference on high-power electron and ion-beam research and technology, Palaiseau, France, 29 Jun-3 Jul 1981)
15	6:32760	*See* SAND-81-0785C
16	6:32751	*See* LBL-12409
CONF-810621-		(Symposium on fluid mechanics of combustion systems, Boulder, CO, USA, 22-24 Jun 1981)
6	6:32700	*See* UCRL-85278
CONF-810642-		(4. DOE battery and electrochemical contractor's conference, Washington, DC, USA, 2-4 Jun 1981)
6	6:32150	*See* DOE/NASA/12726-9
CONF-810644-		(5. international workshop on rare earth-cobalt magnets and their application, Dayton, OH, USA, 6-7 Jun 1981)
1	6:32053	*See* PNL-SA-9318
CONF-810647-		(Conference on X- and gamma-ray sources and applications, Ann Arbor, MI, USA, 10-12 Jun 1981)
10	6:32414	*See* LBL-12493
CONF-810649-		(4. international conference on nuclei far from stability, Helsignor, Denmark, 7-13 Jun 1981)
15	6:32673	*See* PNL-SA-9352
CONF-810651-		(1981 topical conference on low-energy X-ray diagnostics, Livermore, CA, USA, 8-10 Jun 1981)
5	6:32761	*See* SAND-81-0842C
6	6:32766	*See* UCRL-86046
CONF-810659-		(3. IEEE international pulsed power conference, Albuquerque, NM, USA, 1-3 Jun 1981)
21	6:32765	*See* UCRL-85723
22	6:32346	*See* UCRL-85665
23	6:32764	*See* UCRL-85722
29	6:32353	*See* SAND-81-0744C
30	6:32369	*See* SAND-81-0778C
CONF-810673-		(4. symposium on neutron dosimetry, Munich-Neuherberg, F.R. Germany, 1-5 Jun 1981)
4	6:32074	*See* PNL-SA-9461
CONF-810674-		(1981 international conference on residential solid fuels, Portland, OR, USA, 1-5 Jun 1981)
2	6:31585	*See* BNL-29773
3	6:31828	*See* PNL-SA-9618
CONF-810675-		(15. rare earth research conference, Rolla, MO, USA, 15-18 Jun 1981)
3	6:32443	*See* PNL-SA-9161
CONF-810683-		(International joint conference on thermophysical properties, Gaithersburg, MD, USA, 15-19 Jun 1981)
5	6:32693	*See* DOE/ER/01198-1361
CONF-810684-		(APS conference on shock waves in condensed matter, Menlo Park, CA, USA, 23-25 Jun 1981)
46	6:32393	*See* SAND-81-0052C
47	6:32399	*See* UCRL-85381
49	6:32278	*See* SAND-81-0061C
CONF-810694-		(25. Wind River conference on genetic exchange, Estes Park, CO, USA, 8-12 Jun 1981)
3	6:32498	*See* BNL-29853
CONF-8106119-		(Northwest regional American Chemical Society meeting, Bozeman, MT, USA, 17-19 Jun 1981)
2	6:31714	*See* RHO-SA-203
CONF-8106129-		(7. annual peptide symposium, Madison, WI, USA, 15-19 Jun 1981)
1	6:32477	*See* BNL-29738
CONF-8106132-		(International conference on radiation effects in glasses, Arco, Italy, 30 Jun-3 Jul 1981)
1	6:32280	*See* SAND-81-0819C
CONF-8106137-		(WATERPOWER 1981 conference, Washington, DC, USA, 22-24 Jun 1981)
3	6:31797	NTIS, PC A02/MF A01. Order Number DE81027818, Distribution Category MN -97e
CONF-8106139-		(Symposium on inorganic reaction mechanisms, Detroit, MI, USA, 10-12 Jun 1981)
3	6:32305	*See* BNL-29895
CONF-8106142-		(Fusion forum, Auburn, AL, USA, 19 Jun 1981)
1	6:32727	*See* UCRL-86498
CONF-8106143-		(Solar photovoltaic residential project integration meeting, Cambridge, MA, USA, 24-25 Jun 1981)
(Absts.)	6:31837	*See* DOE/ET/20279-150
CONF-8106145-		(1981 workshop on free electron lasers, Sun Valley, ID, USA, 22-25 Jun 1981)
1	6:32347	*See* UCRL-86568
CONF-8106151-		(IAEA conference on nuclear based techniques for in vivo study of human body composition, Upton, NY, USA, 22-26 Jun 1981)
1	6:32503	*See* BNL-29959
CONF-810706-		(Institute of Nuclear Materials Management conference, San Francisco, CA, USA, 13 Jul 1981)
31	6:31763	*See* IS-M-336
CONF-810714-		(Conference on ground control in mining, Morgantown, WV, USA, 27-29 Jul 1981)
2	6:31579	NTIS, PC A02/MF A01. Order Number DE81028042, Distribution Category MN -88
CONF-810719-		(9. international conference on amorphous, Grenoble, France, 2-8 Jul 1981)
2	6:32276	*See* LBL-13040
CONF-810722-		(International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle, Knoxville, TN, USA, 27-31 Jul 1981)
9	6:32446	*See* PNL-SA-9122
10	6:31715	*See* RHO-SA-210
11	6:32447	*See* PNL-SA-9123
CONF-810728-		(9. international conference on atomic collisions in solids, Lyon, France, 6-10 Jul 1981)
5	6:32363	*See* FERMILAB-CONF-81/50-EXP

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CONF-810730-	(1981 national conference on environmental engineering, Atlanta, GA, USA, 8-10 Jul 1981)	
2	6:31695	*See* PNL-SA-9520
CONF-810731-	(14. annual technology meeting of international metallographic society, San Francisco, CA, USA, 21-22 Jul 1981)	
2	6:31531	NTIS, PC A02/MF A01. Order Number DE81027283, Distribution Category MN -90d
CONF-810738-	(4. SALE program participants meeting, Argonne, IL, USA, Jul 1981)	
2	6:31761	NTIS, PC A02/MF A01. Order Number DE81025628, Distribution Category MN -15
CONF-810740-	(3. analytical electron microscopy workshop, Vail, CO, USA, 13-17 Jul 1981)	
2	6:32286	NTIS, PC A02/MF A01. Order Number DE81027285, Distribution Category MN -25
CONF-810741-	(28. sagamore army materials conference, Lake Placid, NY, USA, 13-17 Jul 1981)	
1	6:32225	NTIS, PC A03/MF A01. Order Number DE81027301, Distribution Category MN -25
CONF-810744-	(American Association of Agricultural Economists annual meeting, Clemson, SC, USA, 26-29 Jul 1981)	
1	6:32125	NTIS, PC A03/MF A01. Order Number DE81026521, Distribution Category MN -97c
CONF-810745-	(IAEA technical committee meeting on divertors and impurity control in tokamaks, Garching, F.R. Germany, 6-9 Jul 1981)	
1	6:32732	NTIS, PC A02/MF A01. Order Number DE81026356, Distribution Category MN -20a
CONF-810746-	(International symposium on the fracture mechanics of ceramics, University Park, PA, USA, 15-17 Jul 1981)	
1	6:32266	NTIS, PC A02/MF A01. Order Number DE81028575, Distribution Category MN -25
CONF-810747-	(9. international conference on high energy physics and nuclear structure, Versailles, France, 6-10 Jul 1981)	
1	6:32631	*See* BNL-29774
2	6:32617	*See* DOE/ER/03244-T3
3	6:32648	NTIS, PC A02/MF A01. Order Number DE81026272, Distribution Category MN -34
CONF-810750-	(2. national conference on synchrotron radiation instrumentation, Ithaca, NY, USA, 15-17 Jul 1981)	
1	6:32365	*See* BNL-29837
2	6:32381	*See* BNL-29850
4	6:32373	*See* BNL-29884
CONF-810751-	(2. international symposium on non-conventional energy, Trieste, Italy, 14 Jul-6 Aug 1981)	
1	6:31825	*See* LBL-12960
CONF-810754-	(12. IPEAC international conference on the physics of electronics and atomic collisions, Gatlinburg, TN, USA, 15-22 Jul 1981)	
1	6:32623	*See* LBL-12982
CONF-810801-	(6. international conference on structural mechanics in reactor technology, Paris, France, 17-21 Aug 1981)	
53	6:32006	NTIS, PC A02/MF A01. Order Number DE81029144, Distribution Category MN -79p
55	6:32226	NTIS, PC A02/MF A01. Order Number DE81029141, Distribution Category MN -20
56	6:32073	*See* PNL-SA-9328
CONF-810804-	(20. national heat transfer conference, Milwaukee, WI, USA, 2-5 Aug 1981)	
12	6:32016	*See* PNL-SA-9536
13	6:32063	NTIS, PC A02/MF A01. Order Number DE81028565, Distribution Category MN -79p
14	6:32312	Chicago, IL; Institute of Gas Technology (1981).
CONF-810808-	(Energy in the man-built environment: the next decade specialty conference, Vail, CO, USA, 3-5 Aug 1981)	
5	6:32763	*See* UCRL-84974
CONF-810809-	(16. international conference on low temperature physics, Los Angeles, CA, USA, 19-25 Aug 1981)	
15	6:32227	NTIS, PC A02/MF A01. Order Number DE81029142, Distribution Category MN -34
16	6:32694	NTIS, PC A02/MF A01. Order Number DE81029143, Distribution Category MN -34
CONF-810810-	(SPIE international symposium, San Diego, CA, USA, 24-28 Aug 1981)	
7	6:32758	*See* SAND-81-0580C
20	6:32060	*See* SAND-81-1876C
21	6:32386	NTIS, PC A02/MF A01. Order Number DE81028139, Distribution Category MN -37
22	6:32338	*See* UCRL-86579
CONF-810813-	(National American Chemical Society summer meeting, New York, NY, USA, 23-28 Aug 1981)	
10	6:31713	*See* RFP-3210
12	6:32313	NTIS, PC A02/MF A01. Order Number DE81028061, Distribution Category MN -4
13	6:31686	*See* DP-MS-81-14
CONF-810814-	(91. national meeting of the American Institute of Chemical Engineers, Detroit, MI, USA, 16-19 Aug 1981)	
5	6:32075	*See* PNL-SA-9642
CONF-810827-	(8. AIRAPT conference and 19. EHPRG conference, Uppsala, Sweden, 17-22 Aug 1981)	
6	6:32251	*See* LA-UR-81-2338
7	6:32261	*See* SAND-81-0378C
8	6:32262	*See* SAND-81-0379C
9	6:31655	*See* SAND-81-0334C
CONF-810831-	(Fusion reactor materials meeting, Seattle, WA, USA, 9-12 Aug 1981)	
12	6:32744	*See* GA-A-16407
15	6:32274	NTIS, PC A02/MF A01. Order Number DE81025469, Distribution Category MN -20c
19	6:32228	NTIS, PC A02/MF A01. Order Number DE81028557, Distribution Category MN -20c
20	6:32733	NTIS, PC A02/MF A01. Order Number DE81028214, Distribution Category MN -20c
21	6:32757	*See* SAND-81-0230C
22	6:32257	*See* PNL-SA-9293
23	6:32256	*See* PNL-SA-9285
24	6:32734	NTIS, PC A02/MF A01. Order Number DE81028568, Distribution Category MN -20c
25	6:32229	NTIS, PC A02/MF A01. Order Number DE81028562, Distribution Category MN -20c
26	6:32230	NTIS, PC APC A02/MF A01. Order Number DE81028563, Distribution Category MN -20c
27	6:32231	NTIS, PC A02/MF A01. Order Number DE81028633, Distribution Category MN -20c
28	6:32232	NTIS, PC A02/MF A01. Order Number DE81028879, Distribution Category MN -20c
29	6:32233	NTIS, PC A02/MF A01. Order Number DE81028603, Distribution Category MN -20c
30	6:32234	NTIS, PC A02/MF A01. Order Number DE81028631, Distribution Category MN -20c
31	6:32235	NTIS, PC A02/MF A01. Order Number DE81028065, Distribution Category MN -20c
32	6:32236	NTIS, PC A02/MF A01. Order Number DE81028347, Distribution Category MN -20c
33	6:32237	NTIS, PC A02/MF A01. Order Number DE81028062, Distribution Category MN -20c
34	6:32270	*See* SAND-81-0291C
35	6:32745	*See* GA-A-16429
36	6:32238	NTIS, PC A02/MF A01. Order Number DE81029114, Distribution Category MN -20c
37	6:32735	NTIS, PC A02/MF A01. Order Number DE81028430, Distribution Category MN -20c
38	6:32767	*See* WFPS-TME-81-011

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CONF-810832-		(DOE passive and hybrid solar energy program update, Washington, DC, USA, 9-12 Aug 1981)
5	6:32082	*See* UCRL-86450
CONF-810833-		(Mechanical, magnetic, and underground energy storage 1981 annual contractors' review meeting, Washington, DC, USA, 24-26 Aug 1981)
4	6:32084	*See* Y/DX-338
7	6:32083	*See* UCRL-86557
8	6:31937	*See* PNL-SA-9780
CONF-810835-		(1981 cryogenic engineering conference, San Diego, CA, USA, 10-14 Aug 1981)
3	6:32736	NTIS, PC A02/MF A01. Order Number DE81028561, Distribution Category MN -20b
4	6:31650	*See* LA-UR-81-2365
6	6:32330	NTIS, PC A02/MF A01. Order Number DE81028629, Distribution Category MN -38
7	6:32239	NTIS, PC A02/MF A01. Order Number DE81028632, Distribution Category MN -38
8	6:32737	NTIS, PC A02/MF A01. Order Number DE81028067, Distribution Category MN -20b
9	6:32366	NTIS, PC A02/MF A01. Order Number DE81028066, Distribution Category MN -28
10	6:32240	NTIS, PC A02/MF A01. Order Number DE81028083, Distribution Category MN -20b
11	6:32333	*See* LBL-12782
13	6:32331	NTIS, PC A02/MF A01. Order Number DE81028058, Distribution Category MN -20b
14	6:32753	*See* LBL-13034
15	6:31947	*See* BNL-29932
CONF-810838-		(Conference on oil shale, the environmental challenges II, Vail, CO, USA, 10-13 Aug 1981)
1	6:32583	*See* LA-UR-81-2309
CONF-810841-		(12. NATO/CCMS international technical meeting on air pollution modeling and its applications, Menlo Park, CA, USA, 25-28 Aug 1981)
1	6:32429	*See* UCRL-85520
CONF-810842-		(American Statistical Association meeting, Detroit, MI, USA, 10-13 Aug 1981)
1	6:32779	NTIS, PC A03/MF A01. Distribution Category MN -32
2	6:32348	NTIS, PC A02/MF A01. Order Number DE81028566, Distribution Category MN -32
CONF-810843-		(Acid rain/fisheries symposium, Ithaca, NY, USA, 2-5 Aug 1981)
1	6:32457	*See* BNL-29793
CONF-810844-		(Gordon conference on nonlinear optics and lasers, Wolfesboro, NH, USA, 3-7 Aug 1981)
1	6:32345	*See* LA-UR-81-2348
CONF-810845-		(4. workshop on gases in strong rotation, Oxford, UK, 24-27 Aug 1981)
1	6:31679	*See* K/OA-5013
CONF-810847-		(28. international union of pure and applied chemistry symposium, Vancouver, British Columiba, Canada, Aug 1981)
1	6:31760	*See* AGNS-35900-Conf-137
CONF-810848-		(International Institute for Applied Systems Analysis workshop on model validity and credibility, Vienna, Austria, 4-11 Aug 1981)
1	6:32776	NTIS, PC A03/MF A01. Order Number DE81028215, Distribution Category MN -13
CONF-810850-		(Annual meeting of the Australian Radiation Protection Society, Sydney, Australia, 24-27 Aug 1981)
1	6:32690	NTIS, PC A02/MF A01. Order Number DE81028140, Distribution Category MN -41
CONF-810851-		(4. international conference on rapidly quenched metals, Sendai, Japan, 24-28 Aug 1981)
1	6:32275	NTIS, PC A02/MF A01. Order Number DE81028138, Distribution Category MN -34
CONF-810852-		(Seminar on radiation behavior of materials and its impact on fusion reactor design, Paris, France, 24-25 Aug 1981)
1	6:32738	NTIS, PC A04/MF A01. Order Number DE81028063, Distribution Category MN -20c
CONF-810853-		(International conference on electron transport in metals, Ottawa, Canada, 13-15 Aug 1981)
1	6:32241	NTIS, PC A02/MF A01. Order Number DE81028073, Distribution Category MN -34
CONF-810854-		(X-ray analysis conference, Denver, CO, USA, 3-7 Aug 1981)
1	6:32292	*See* RFP-3214
CONF-810855-		(American Society of Civil Engineers annual meeting, Vail, CO, USA, 3-5 Aug 1981)
1	6:31569	NTIS, PC A02/MF A01. Order Number DE81028567, Distribution Category MN -90i
CONF-810861-		(OECD Nuclear Energy Agency workshop on near-field phenomena in geologic respositories for radioactive waste, Seattle, WA, USA, 31 Aug-3 Sep 1981)
1	6:31741	*See* UCRL-86043
CONF-810862-		(Illuminating Engineering Society annual technical conference, Toronto, Canada, 9-13 Aug 1981)
1	6:32164	*See* LBL-12599
CONF-810905-		(ANS/ENS topical meeting on probabilistic risk assessment, Post Chester, NY, USA, 20-24 Sep 1981)
4	6:32076	*See* SAND-81-1707C
CONF-810912-		(Annual DOE active solar heating and cooling contractor's review meeting, Washington, DC, USA, Sep 1981)
12	6:31857	*See* LBL-12752
CONF-810913-		(International conference on environmental degradation of engineering materials, Blacksburg, VA, USA, 21-23 Sep 1981)
7	6:31980	*See* PNL-SA-9387
CONF-810920-		(4. international symposium on neutron-capture gamma-ray spectroscopy and related topics, Grenoble, France, 7-11 Sep 1981)
7	6:32681	*See* BNL-29809
8	6:32675	NTIS, PC A02/MF A01. Order Number DE81029670, Distribution Category MN -34C
9	6:32667	NTIS, PC A02/MF A01. Order Number DE81029665, Distribution Category MN -34C
10	6:32669	NTIS, PC A02/MF A01. Order Number DE81029668, Distribution Category MN -34C
11	6:32670	NTIS, PC A02/MF A01. Order Number DE81029671, Distribution Category MN -34C
12	6:32687	NTIS, PC A02/MF A01. Order Number DE81029673, Distribution Category MN -34C
13	6:32688	NTIS, PC A02/MF A01. Order Number DE81029676, Distribution Category MN -34C
CONF-810923-		(7. underground coal conversion symposium, Fallen Leaf Lake, CA, USA, 8-12 Sep 1981)
8	6:31555	*See* UCRL-85906
CONF-810925-		(6. national passive conference, Portland, OR, USA, 8-12 Sep 1981)
17	6:31863	*See* SERI/TP-721-1138R
19	6:31802	*See* LBL-12967
20	6:31803	*See* SERI/TP-643-1324
CONF-810926-		(11. symposium on explosives and pyrotechniques, Philadelphia, PA, USA, 15-17 Sep 1981)
3	6:32394	*See* SAND-81-0487
4	6:32310	*See* MLM-2856(OP)
CONF-810927-		(3. symposium on turbulent shear flow, Davis, CA, USA, 9-11 Sep 1981)
1(Rev.)	6:32349	*See* LBL-12009-Rev.
CONF-810931-		(1. symposium on gages and piezoresistive materials, Archon, France, 29 Sep-1 Oct 1981)
2	6:32391	*See* UCRL-85763
CONF-810933-		(IGRC 1981 conference, Chicago, IL, USA, 28-29 Sep 1981)
1	6:32122	*See* BNL-29764
CONF-810934-		(Conference on earthquakes and earthquake engineering: the Eastern United States, Knoxville, TN, USA, 14-16 Sep 1981)
1	6:32332	*See* K-BD-1053
CONF-810935-		(2. international symposium on numerical methods and heat transfer, College Park, MD, USA, 28-30 Sep 1981)
1	6:32407	*See* UCRL-85555

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CONF-810936-		(5. annual patent conference of the Bureau of National Affairs, Inc., Arlington, VA, USA, 9-11 Sep 1981)
1	6:32801	*See* LA-UR-81-2369
CONF-810940-		(Annual meeting on thermal and chemical storage, Tysons Corner, VA, USA, 16 Sep 1981)
1	6:31883	*See* SAND-81-1868C
2	6:32085	*See* SERI/TP-253-1369
CONF-810941-		(ANS technical base for nuclear fuel cycle policy, Newport, RI, USA, 20-23 Sep 1981)
2	6:31687	*See* GA-A-16405
CONF-810943-		(Conference on chemistry of materials at high temperatures, Harwell, Oxfordshire, UK, 7-10 Sep 1981)
3	6:32263	*See* UCRL-85554
CONF-811001-		(2. Charlottesville Conference on high density penetration materials, Charlottesville, VA, USA, 14-16 Oct 1981)
1	6:32260	*See* SAND-80-1442C
CONF-811002-		(7. AIAA aerodynamic decelerator and balloon technology conference, San Diego, CA, USA, 21-23 Oct 1981)
2	6:32335	*See* SAND-78-1744C
CONF-811003-		(ASNT fall conference, Atlanta, GA, USA, 12-15 Oct 1981)
1	6:32350	*See* KAPL-4129
2	6:32242	NTIS, PC A02/MF A01. Distribution Category MN -79k
CONF-811005-		(Symposium on intermediate range atmospheric transport processes and technology assessment, Gatlinburg, TN, USA, 1-3 Oct 1981)
1	6:32434	*See* DP-MS-81-20
CONF-811006-		(International conference on energy use management--III, West Berlin, F.R. Germany, 26-30 Oct 1981)
1	6:32450	*See* LA-UR-81-899
2	6:31864	*See* SERI/TP-733-1278
3	6:32165	*See* LBL-12862
CONF-811007-		(2. world congress of chemical engineering, Montreal, Canada, 4-9 Oct 1981)
1	6:32309	*See* LBL-12377
2	6:32303	*See* BNL-29364
4	6:31770	*See* BNL-29461
5	6:31772	*See* BNL-29520
6	6:31849	NTIS, PC A02/MF A01. Order Number DE81025018, Distribution Category MN -59b
CONF-811008-		(ASME/IEEE joint power generation conference, St Louis, MO, USA, 4-8 Oct 1981)
1	6:31996	*See* GA-A-16342
2	6:32007	*See* CRBRP-GEFR-SP-241
CONF-811009-		(Biophysical discussion on protein-lipid interaction in membranes, Airlie House, VA, USA, 3-6 Oct 1981)
1	6:32476	*See* BNL-29466
CONF-811010-		(6. electric vehicle council symposium, Baltimore, MD, USA, 21-23 Oct 1981)
1	6:32090	*See* DOE/NASA/51044-16
3	6:32214	*See* UCRL-85526
CONF-811011-		(7. inter-american conference on materials technology, Mexico City, Mexico, Oct 1981)
1	6:31981	*See* UCRL-84168
CONF-811012-		(IEEE symposium on nuclear science, San Francisco, CA, USA, 21-23 Oct 1981)
1	6:32377	*See* LBL-12587
CONF-811013-		(Electrochemical Society conference, Denver, CO, USA, 11-16 Oct 1981)
1	6:32223	*See* BNL-29589
2	6:32304	*See* BNL-29580
3	6:32093	*See* LBL-13076
CONF-811014-		(11. North American Thermal Analysis Society conference, New Orleans, LA, USA, 19-21 Oct 1981)
1	6:32272	*See* MLM-2836(OP)
2	6:31549	*See* SAND-81-0715C
CONF-811015-		(Geothermal Resources Council annual meeting, Houston, TX, USA, 25-29 Oct 1981)
1	6:31906	*See* SAND-81-1342C
2	6:31907	*See* SAND-81-1462C
3	6:31910	*See* SAND-81-1502C
4	6:31909	*See* SAND-81-1490C
5	6:31903	*See* LA-UR-81-1769
6	6:31908	*See* SAND-81-1470C
9	6:31892	*See* LA-UR-81-1956
10	6:31891	*See* LA-UR-81-1806
11	6:31904	*See* LA-UR-81-1783
12	6:31905	*See* LA-UR-81-1786
14	6:31884	*See* LBL-12820
CONF-811017-		(IEEE/IAS annual meeting, Philadelphia, PA, USA, 5-9 Oct 1981)
1	6:32163	*See* LBL-12462
2	6:32162	*See* LBL-12461
CONF-811018-		(Showcase for technology conference, Albuquerque, NM, USA, 28-30 Oct 1981)
1	6:31895	*See* SAND-81-1384C
CONF-811019-		(Symposium on interatomic potentials and computer simulation of defects in metals, Pittsburgh, PA, USA, 6-7 Oct 1981)
1	6:32243	NTIS, PC A02/MF A01. Order Number DE81025159, Distribution Category MN -25
CONF-811021-		(31. annual meeting of the Gulf Coast Association of Geological Societies, Corpus Christi, TX, USA, 21-23 Oct 1981)
1	6:31886	NTIS, PC A02/MF A01. Order Number DE81026014, Distribution Category MN -66a
CONF-811022-		(Conference on effects of interfaces on deformation and fracture, Louisville, KY, USA, 11-15 Oct 1981)
1	6:32244	NTIS, PC A02/MF A01. Order Number DE81025545, Distribution Category MN -25
CONF-811023-		(1981 SPE annual technical conference and exhibition, San Antonio, TX, USA, 4-7 Oct 1981)
1	6:31911	*See* SAND-81-1634C
2	6:32356	*See* SAND-81-0575C
3	6:31649	*See* DOE/ET/27081-6
4	6:32337	*See* SAND-81-0747C
CONF-811026-		(5. geopressured-geothermal energy conference, Baton Rouge, LA, USA, 13-15 Oct 1981)
3	6:31900	*See* UCRL-86547
4	6:31902	*See* DOE/ET/27081-T1
7	6:31916	NTIS, PC A02/MF A01. Order Number DE81029771, Distribution Category MN -66a
9	6:31887	NTIS, PC A02/MF A01. Order Number DE81029799, Distribution Category MN -66a
10	6:31888	NTIS, PC A02/MF A01. Order Number DE81029782, Distribution Category MN -66a
CONF-811027-		(Eastern section: the combustion institute conference, Pittsburgh, PA, USA, 27-29 Oct 1981)
1	6:31556	*See* UCRL-86518
CONF-811028-		(23. annual meeting of the division of plasma physics of the APS, New York, NY, USA, 12-16 Oct 1981)
(Absts.)	6:32717	*See* DOE/ET/53051-24
CONF-811029-		(International Society for Hybrid Microelectronics meeting, Chicago, IL, USA, 12-14 Oct 1981)
1	6:32279	*See* SAND-81-0590C
CONF-811031-		(DOE statistics symposium, Berkeley, CA, USA, 27-29 Oct 1981)
1	6:32787	*See* PNL-SA-9370
CONF-811032-		(Human Factors Society meeting, Rochester, NY, USA, 12-16 Oct 1981)
1	6:32791	*See* SAND-81-1860C
CONF-811103-		(ANS winter meeting, San Francisco, CA, USA, 29 Nov-4 Dec 1981)
40	6:32762	*See* UCRL-15376
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1560-15	6:32056	*See* DOE/ER/01560-15
1671-87	6:32691	*See* DOE/EV/01671-T1
1671-88	6:32691	*See* DOE/EV/01671-T1
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241	6:32007	NTIS, PC A02/MF A01. Order Number DE81026358, Distribution Category MN -79p
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T1	6:31786	NTIS, PC A02/MF A01. Order Number DE81030158, Distribution Category MN -61a
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T1	6:31810	NTIS, PC A02/MF A01. Order Number DE81028307, Distribution Category MN -61a
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5	6:31645	NTIS, PC A06/MF A01. Order Number DE81030006, Distribution Category STD -92a
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21	6:31636	NTIS, PC A07/MF A01. Order Number DE81029458, Distribution Category STD -92b
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4	6:31620	NTIS, PC A04/MF A01. Order Number DE81029491, Distribution Category STD -92a
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81/ 2	6:31621	NTIS, PC A08/MF A01. Order Number DE81029998, Distribution Category STD -92a
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1	6:32197	NTIS, PC A04/MF A01. Order Number DE81028116, Distribution Category MN -95
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1	6:32157	NTIS, PC A12/MF A01. Order Number DE81029836, Distribution Category MN -32
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0004	6:32096	NTIS, PC A09/MF A01. Order Number DE81029827, Distribution Category MN -98
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1	6:32198	NTIS, PC A07/MF A01. Order Number DE81029816, Distribution Category STD -95e
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1	6:32199	NTIS, PC A08/MF A01. Order Number DE81029999, Distribution Category STD -95e
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2	6:31776	NTIS, PC A03/MF A01. Order Number DE81030144, Distribution Category STD -95e
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4	6:32158	NTIS, PC A05/MF A01. Order Number DE81027971, Distribution Category MN -95d
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6	6:31851	NTIS, PC A05/MF A01. Order Number DE81028156, Distribution Category MN -59
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T1	6:32184	NTIS, PC A06/MF A01. Order Number DE81029027, Distribution Category MN -61a
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1	6:32207	NTIS, PC A13/MF A01. Order Number DE81029996, Distribution Category STD -96
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044	6:32432	NTIS, PC A02/MF A01. Order Number DE81029955, Distribution Category MN -11
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0029	6:31678	NTIS, PC A04/MF A01. Order Number DE81029952, Distribution Category STD -10
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1361	6:32693	NTIS, PC A02/MF A01. Order Number DE81028180, Distribution Category MN -34
1362	6:32616	NTIS, PC A06/MF A01. Order Number DE81029490, Distribution Category MN -34
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494	6:32780	NTIS, PC A02/MF A01. Order Number DE81028322, Distribution Category MN -32
495	6:32781	NTIS, PC A02/MF A01. Order Number DE81028318, Distribution Category MN -34D
496	6:32782	NTIS, PC A02/MF A01. Order Number DE81028321, Distribution Category MN -32
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15	6:32056	NTIS, PC A02/MF A01. Order Number DE81028525, Distribution Category MN -80
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T1	6:32632	NTIS, PC A02/MF A01. Order Number DE81028385, Distribution Category MN -34D
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1	6:32314	NTIS, PC A02/MF A01. Order Number DE81030161, Distribution Category MN -4
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T2	6:32633	NTIS, PC A03/MF A01. Order Number DE81028305, Distribution Category MN -34D
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29	6:32221	NTIS, PC A02/MF A01. Order Number DE81028489, Distribution Category MN -25
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2	6:32661	NTIS, PC A04/MF A01. Order Number DE81028388, Distribution Category MN -20c
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7	6:31901	NTIS, PC A03/MF A01. Order Number DE81030045, Distribution Category MN -66b
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5	6:32267	NTIS, PC A03/MF A01. Order Number DE81028482, Distribution Category MN -25
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26	6:32634	NTIS, PC A05/MF A01. Order Number DE81028408, Distribution Category MN -34D
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T1	6:32658	NTIS, PC A12/MF A01
T1	6:32676	NTIS, PC A12/MF A01
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440	6:32696	NTIS, PC A03/MF A01. Order Number DE81028695, Distribution Category MN -34D
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82655	6:32150	*See* DOE/NASA/12726-9
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81-2191(DOE)	6:31547	NTIS, PC A05/MF A01. Order Number DE81029486, Distribution Category MN -90c
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568(D)	6:32070	NTIS (US Sales Only), PC A03/ MF A01. Order Number DE81904080, Distribution Category STD -79e
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190438	6:31801	Bombay, India; Tata Energy Research Institute (1981).
1903909	6:31677	Sante Fe, New Mexico; New Mexico Energy and Minerals Department (1981).
1903961	6:32102	Rio de Janeiro, Brasil; Federative Republic of Brazil (1980).
1903985	6:32118	Austin, TX; University of Texas (1981).
1904011	6:31880	Santa Fe, NM; New Mexico Energy and Minerals Dept. (Jul 1981).
1904014	6:31629	NTIS (US Sales Only), PC A09/ MF A01. Order Number DE81904014, Distribution Category MN -92
1904016	6:31918	NTIS (US Sales Only), PC A08/ MF A01. Order Number DE81904016, Distribution Category MN -60
1904114	6:31567	Kansas City, MO; Standard Havens, Inc. (1981).
81903394	6:31870	Santa Fe, NM; New Mexico Energy and Minerals Dept. (1981).
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5596	6:32326	NTIS, PC A03/MF A01. Order Number DE81028028, Distribution Category STD -4
5698	6:31998	NTIS, PC A07/MF A01. Order Number DE81030429, Distribution Category STD -77
5781	6:32254	NTIS, PC A04/MF A01. Order Number DE81028030, Distribution Category STD -90h
5792	6:32024	NTIS, PC A04/MF A01. Order Number DE81029098, Distribution Category STD -79d
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5806	6:32471	NTIS, PC A04/MF A01
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7892	6:32470	NTIS, PC A10/MF A01. Order Number DE81030261, Distribution Category MN -13
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81-855074	6:32611	NTIS PCN01/MF N01
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81-4	6:32742	*See* DOE/ET/51013-T1
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